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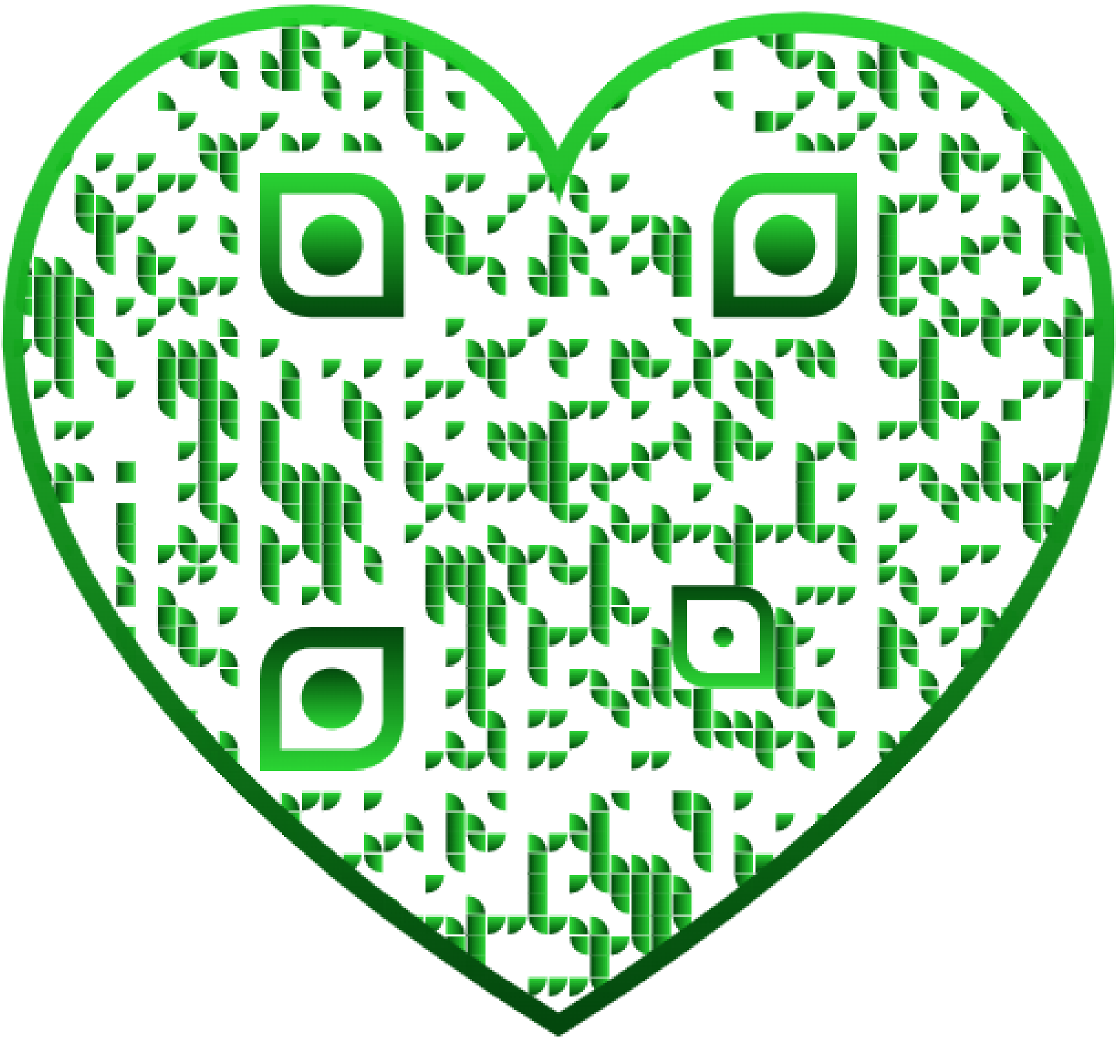

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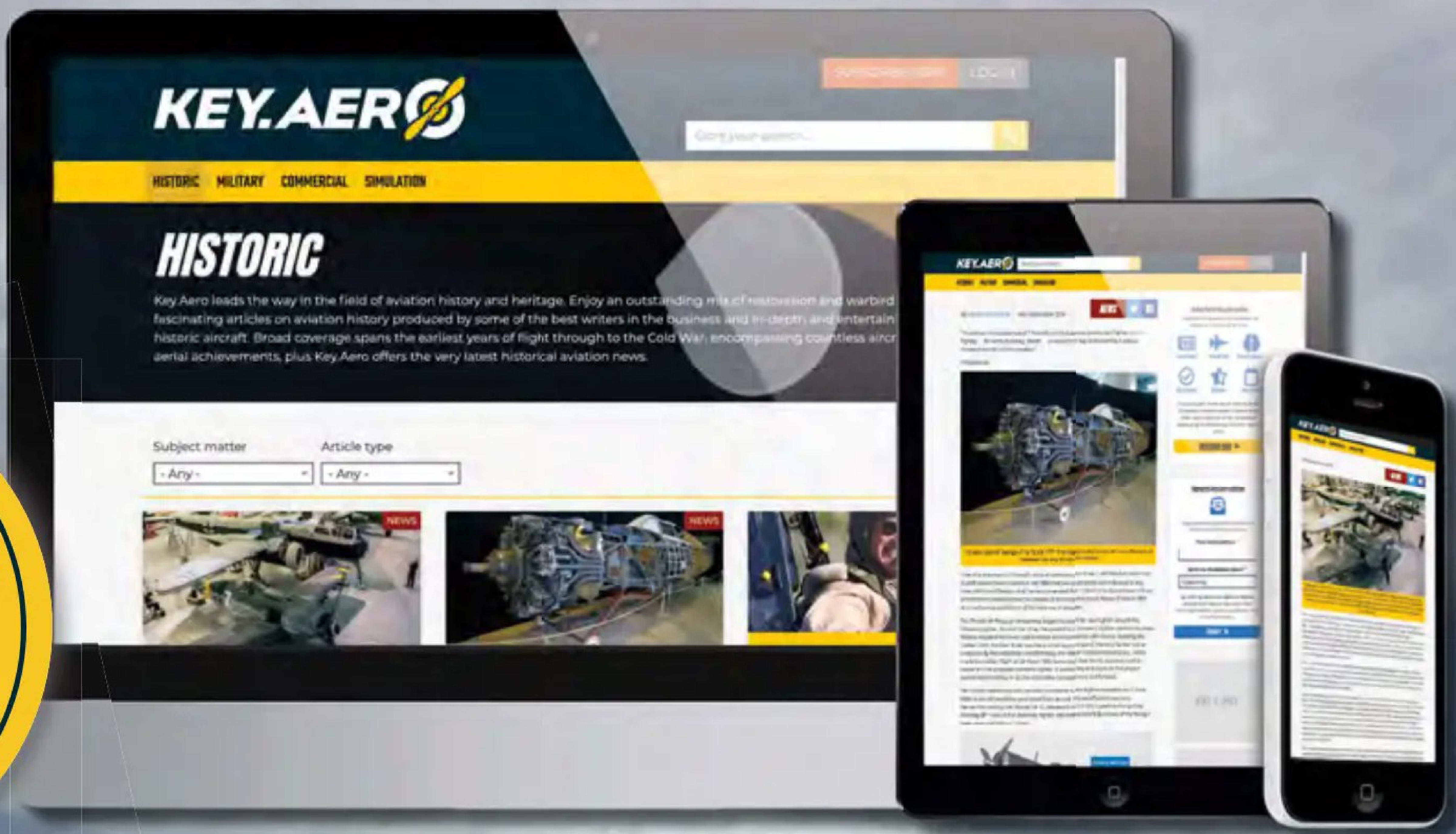
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Welcome

This year is looking set to usher in significant changes and developments across all sectors of the aerospace industry. With the prospect of the US seeking to adjust its approach to Europe and NATO, and Russia's ongoing 'military operation' in Ukraine, defence procurement and upgrading for nations who may well be feeling the pressure.

For the first time in decades, defence procurement is focusing on a type of warfare away from the nuclear philosophy. The new Cold War demands fresh tactics and equipment to support a doctrine of deep precision strikes or raids by special forces. Such operations will be supported by a host of unmanned systems, many of which are increasing in their AI capabilities. Against the need to upgrade and replace is the requirement to be 'on station', whether it's a show of force in the Pacific Ocean or meeting a probing Russian bomber on the fringe of NATO's airspace, All this is stretching budgets and personnel to the limit. The need to balance a nation's spending and have the tools to provide a suitable deterrent is resulting in countless debates across the capitals of Europe.

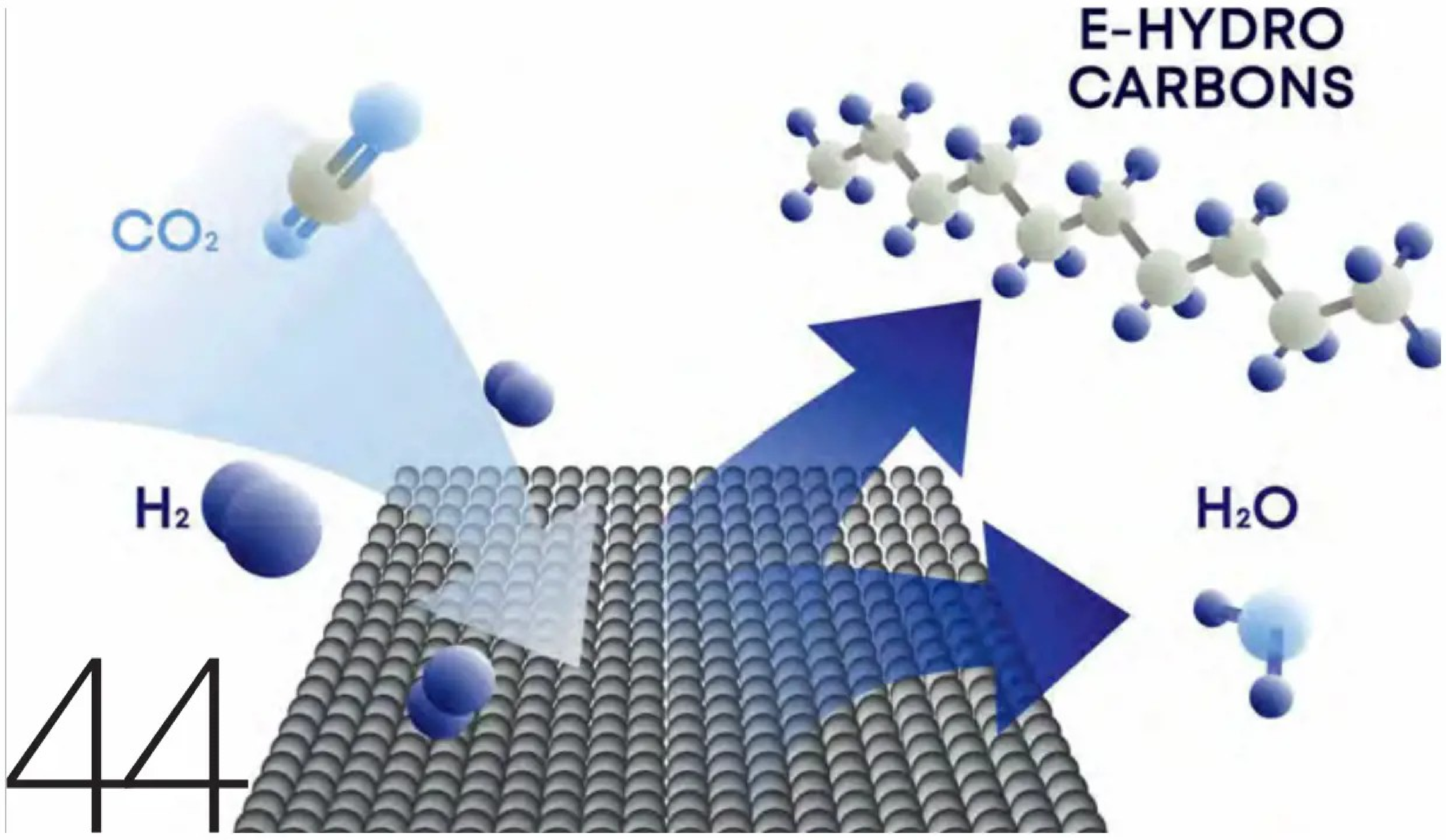
But it's not all military deterrence and power projection. Tthe prospect of a return to supersonic commercial travel is now firmly becoming a reality with the series of test flights by Boom Supersonic's XB-1 due to be completed this year. The most recent of these reached a speed of Mach 0.82 at 25,000ft on November 16, 2024. Along with establishing an airliner factory in the US to build Overture, which already has 130 pre-orders, the second dawn of supersonic commercial travel is assured.

Add to this the ongoing eVTOL trials and the enthusiasm of cities worldwide for adopting reliable 'airborne taxis' within their networks, 2025 may well be viewed as the year when things really got started across all sectors.

Glenn Sands
Editor

TOP:
One of the most dynamic aerospace programmes is the XB-1 from Boom Supersonic. Before long, this technology demonstrator will be breaking the sound barrier in skies over California
Boom Supersonic

FRONT COVER:
The H225M Caracal is proving itself to be the helicopter of choice for nations seeking a multi-mission capable platform that they can tailor to their specific needs
Airbus Helicopters/Anthony Pecchi



06 News General Atomics' persistent protection, RAF's helicopter fleet to be slashed in defence cuts, Emirates receives its first A350-900, RAF Hawk T2s not meeting training needs

12 Commercial outlook Continued supply chain challenges, digital transformation and technological change are all on the commercial aerospace agenda in 2025. Mark Broadbent reports

20 Ready in anticipation Glenn Sands speaks to Airbus Helicopters about why its H225M Caracal is becoming the helicopter of choice for CSAR and Special Operations forces

30 On the brink Scrapping plans to create a new national carrier is the latest problem for Nigeria's airline sector. Alan Dron examines the current crisis

36 A full-service future Air Astana president and CEO Peter Foster is focused on building a high-quality airline group. Michael Doran asked how it's developing

44 Creating the catalyst for carbon-neutral flights Bernie Baldwin talks with Andrew Symes, founder and CEO of OXCCU, a company looking to get aviation to net zero with SAF

EI-KGB
AIRBUS A321neo

Contents

29

Subscription Offer
A subscription to *Air International* offers great savings on the cover price
See page 29 for details

50 **Is there a European 'sixth-generation' future outside FCAS/SCAF and GCAP?** Many have questioned whether Europe can support two next-generation manned air dominance programmes, ignoring the fact that further projects are also underway in Sweden and Turkey

58 **Keeping charters competitive** Glenn Hogben, CEO of The Air Charter Association, explains why the increase in Air Passenger Duty will make the sector increasingly uncompetitive

62 **Space 2025** Exciting new missions are afoot in 2025, including Artemis II sending astronauts to the Moon. Mark Broadbent boldly goes forth

68 **From sketchbook to the skies** Hong Kong's flag carrier, Cathay Pacific, is transforming its passenger experience. Alex Preston spoke to those responsible for making artistry take flight

78 **Eight Questions** Recently appointed to the position of CEO at MAAS Aviation, Danny Hakker spoke to *Air International* about the company's strategic direction

Instability in Asia

There's a growing sense of urgency with nations in the Indo-Pacific region that there's a need to quietly upgrade their military capabilities and seek new technology to provide a more robust defence for their country's interests within the next few years. Concern about Russia's invasion of Ukraine has rippled across the vast Pacific Ocean, with fears for many nations with a Western-style outlook about China's threat within the region. The rapid expansion of China's armed forces over the last few years and a more aggressive stance over disputed island chains in the South and East China Seas has led to many countries looking for cutting-edge technology that can offer effective means of monitoring and countering threats if necessary, and achieving this without a significant increase to their already hard-pressed defence budgets.

Sensing an opportunity in the region, General Atomics Aeronautical Systems (GA-ASI) spent much of 2024 demonstrating the capabilities of its unmanned air system (UAS) and what such platforms can offer.

In August 2024, GA-ASI deployed one of its MQ-9B SeaGuardian systems, a maritime derivative of the MQ-9B SkyGuardian, to the international maritime exercise RIMPAC. The SeaGuardian provided ISR data feeds to the US Pacific Fleet Command Center using signals intelligence (SIGINT) parametrics and full-motion video to the watch floor and intelligence centres for real-time dynamic tasking. In addition, the MQ-9B provided long-range anti-ship missile (LARSM) targeting and a new sonobuoy dispensing system (SDS) to support anti-submarine warfare. SeaGuardian was configured with a prototype SDS pod capable of deploying ten A-size sonobuoys per pod. The SeaGuardian can carry up to four SDS pods of 40 sonobuoys and the SeaVue multi-role radar from Raytheon. Once the RIMPAC trials had ended, the MQ-9B SeaGuardian self-deployed from Hawaii to its home base in El Mirage, California.

The success of the SeaGuardian RPA trials in the exercise was further endorsed by the announcement that the Japan Coast Guard (JCG) has signed a contract for two of the RPAs from GA-ASI, which are scheduled for delivery in 2025. This follows the JCG's ongoing company-owned, contractor-operated agreement with GA-ASI for overseeing SeaGuardian, which began in April 2022.

GA-ASI CEO Linden Blue said: "Since JCG started operating SeaGuardians, they have been used for various JCG missions, including supporting search and rescue and disaster response, and maritime surveillance during the G-7 Summit in Hiroshima, and the system has performed efficiently and effectively."

Recent trials with Gray Eagle STOL aboard the South Korean Navy's amphibious landing ship Dokdo in November saw the UAS take off from the ship, which was underway off the coast of Pohang, South Korea, and fly to the Pohang Navy airfield to land. It was a pioneering mission for the platform, and the capabilities of the Gray Eagle STOL may be precisely what South Korea needs. At present, it is the only medium-altitude, long-endurance aircraft with the ability to operate from large-deck warships, amphibious vessels and aircraft carriers, as well as short and unprepared landing strips. The 2024 test with the South Korean military has only validated what GA-ASI has been saying to nations in the region about its platforms, their capability and versatility, as well as advising on the areas that need to be monitored constantly without having to rely on manned aircraft or slow-transiting naval ships to ensure maritime security.

For GA-ASI, the Indo-Pacific requires constant surveillance and monitoring to counter threats to trade routes. Remote island outposts require persistent, unmanned, mission-capable platforms to ensure that, for the time being, a status

quo is maintained. It's a requirement that the company is only too happy to satisfy.–

The MQ-9B STOL is already being developed, integrating a wing and tail kit developed on the smaller Mojave. This type conducted trials at the US Army's Yuma Proving Ground in Arizona in April 2024, armed with two 7.62mm Dillion Aero DAP-6 minigun pods under each wing, each of which was capable of firing 3,000 rounds per minute. The Mojave is also being promoted as one of the currently available RPAs that can deliver logistics within contested airspace, potentially supporting reconnaissance or special forces operating behind enemy lines.

The MQ-9B STOL will offer operators the capability to operate from more expeditionary bases or large-deck amphibious ships. The RPA will be able to stay where it's needed for longer and will virtually always be ready for tasking, whether operating with ground or maritime forces. One of the most significant capabilities that any RPA offers is persistence, particularly in a mission profile that requires anti-surface and anti-submarine warfare.

The build-up of China People's Liberation Army Navy (PLAN) is posed to overtake the US Navy in several areas of maritime might. If China continues to expand its fleet at the current pace and the US does not revitalise its shipbuilding industry, China is increasingly likely to emerge victorious in a state-on-state war in the region. At present, China is confidently projecting power within the Indo-Pacific and is routinely threatening its less powerful neighbours, as well as disregarding US efforts to deter such actions.

According to defence analysts, China now has the largest maritime fighting force in the world, including 22 missile-armed corvettes recently transferred to the China Coast Guard. The US holds an advantage in submarine capability, with 66 nuclear vessels compared to China's 12, but this gap is set to close with China's submarine force set to grow to 80 vessels by 2035. China's anti-submarine warfare doctrine has seen significant upgrades in assets and capabilities in recent years, with neighbouring nations now lagging behind in this capability. Perhap the quickest and most suitable option to avoid losing the 'maritime-projection capability' with the Indo-Pacific is to introduce an RPA fleet capable of providing long-endurance oversight on a routine basis. **AI**

OPPOSITE:
MQ-9B STOL will enable organic anti-submarine warfare and fleet defence missions without the need to return to a conventional land-based airfield for refuelling and maintenance
images via General Atomics

ABOVE:
SeaGuardian integrates the most advanced maritime intelligence, surveillance and reconnaissance (ISR) capabilities, but also has the first RPAS in its class to enable real-time search and patrol above and below the ocean's surface

BELOW:
SkyGuardian is designed to fly over the horizon via satellite for up to 40+ hours in all weather and safely integrate into civil airspace to deliver real-time situational awareness anywhere in the world, day or night

Cutting cost or

TOP LEFT:
The retirement of the Puma fleet and reduction of Chinook airframes raises the question of whether they can all now be accommodated at RAF Odiham in the future and whether RAF Benson could be closed.
Both images MOD Crown Copyright

TOP RIGHT:
Removing older Chinook variants looks set to benefit the fleet in the long term with the arrival of the MH-47G Block IIs and allowing MLUs to occur on newer variants currently in operational service

Throughout its election campaign in 2024, the UK Labour party said that if successful, a thorough Strategic Defence Review (SDR) would take place within a year of it coming into power. They also pledged an additional £3bn for the defence budget, but this would be a one-off payment rather than a long-term funding settlement.

As a precursor to what may now lay ahead for the Ministry of Defence, with the SDR predicted to occur in spring 2025, the Defence Secretary John Healey recently announced, on November 20, 2024, a swath of defence cuts to save the UK £500m by scrapping old military equipment earlier than planned, much of which, according to the government, had been in service for decades and had been little used – old capabilities that had been superseded and required replacement in the near future. Following the cuts, and as a precursor to the SDR perhaps, Healey stated: “These are not the only difficult decisions we will need to make as a new government to deal with the fiscal inheritance.” He added that the changes would “secure better value for money for taxpayers and better outcomes for our military.”

But examining what is being withdrawn, is there justification for some of the backlash in the broader media regarding the UK’s loss in capability? Examining the air assets that are to be retired or withdrawn in relation to Air International’s focus, the removal of airframes that are well past their service lives and, in a modern battlefield arena, as we see in Ukraine, would not survive in a hostile environment is indeed justification for the withdrawal of older models and systems.

Much of the recent defence cuts focused on the rotary assets within the RAF’s fleet. A breakdown of the types involved, the Chinook and Puma, offers some validation for withdrawing some airframes.

Regarding the Chinook fleet, the 14 Lot 1 CH-47s currently in service with the RAF were previously mentioned regarding their withdrawal. Still, only nine airframes were mentioned at that time. The increase to 14, all of which are due to be replaced by 12-14 MH-47G Block IIs, which are already on order and due in approximately three years, addresses this shortfall.

capability...

The Lot 1 Chinooks the RAF currently operate have seen extensive service, suffering damage through accidents or on the frontline and have been upgraded multiple times. The retirement of these older models will likely, in the long-term, improve force generation across the Chinook fleet in terms of the next Mid-Life Upgrade (MLU) along with the Capability Sustainment Plan (CSP), which is intended to follow after the arrival of the MH-47Gs into RAF service. These plans will upgrade the remaining Mk 5/6/6A airframes in service to a similar standard to that of the CH-47F Block II. Additionally, the recovery of spares from the 14 retired aircraft will assist Boeing in putting more aircraft on the line at RAF Odiham and RAF Benson via through life customer support (TLCS) in the short term.

In terms of the Puma, the rumours that a three-year extension contract had not been signed earlier this year to support the Puma fleet, which stands at 23 aircraft, was the first indication that the type might be facing accelerated retirement. According to a source within the MOD, the planning assumption had always been, when they were involved in the Puma Life-Extension Programme back in 2010, that the type was due to leave RAF service in 2025, and no replacement at that time was considered or funded. The Future Medium Lift (FML), which was effectively to be a Puma replacement, was cancelled in order to fund the 14 new CH-47Fs (Mk 6s) in 2008; these were to be followed by a further ten examples then on order but subsequently cancelled by the 2010 SDR. The specific announcement that 17 Pumas will be retired asks the question as to what the current state of the six other airframes is, whether they have already been reduced to spare parts, or whether the Pumas operating in Cyprus and Brunei will carry on until the proposed H145s are ready. A potential 'gap filling' contract appears unlikely due to the unacceptable loss of support that the Pumas currently provide in these locations, which will be unacceptable to other service units operating in the regions. The possibility is that these six Pumas may well get a six-month extension effectively to cover the H145s' arrival, which is not expected until late 2025.

The possibility of further defence cuts to be announced in 2025 by Labour following their SDR raises a few options. Air International asked a former RAF pilot and MOD source what may be ahead. Their view is that the NMH should be culled in the SDR, with Leonardo given some incentive to 'properly' engage with Bell and the Next Generation Rotorcraft Capability (NGRC) to ascertain how they could build and integrate UK equipment into this and at what cost, a proposed figure of no more than $38.2m (£30m) per aircraft has been openly quoted.

At the same time, the MOD does need to readdress its rotary wing doctrine, according to this source, to see if it's an NGRC or FLRAA 'need' in the mid-2030s. The £1bn+ saved by culling the Puma and NMH could be reinvested either in a small batch of Typhoons to keep the production line busy while awaiting the GCAP/Tempest production line or by improving the British Army's capabilities, which have been hollowed out by sending equipment to Ukraine leaving some notable gaps in capabilities despite the upbeat talk in recent parliamentary meetings involving senior service heads.

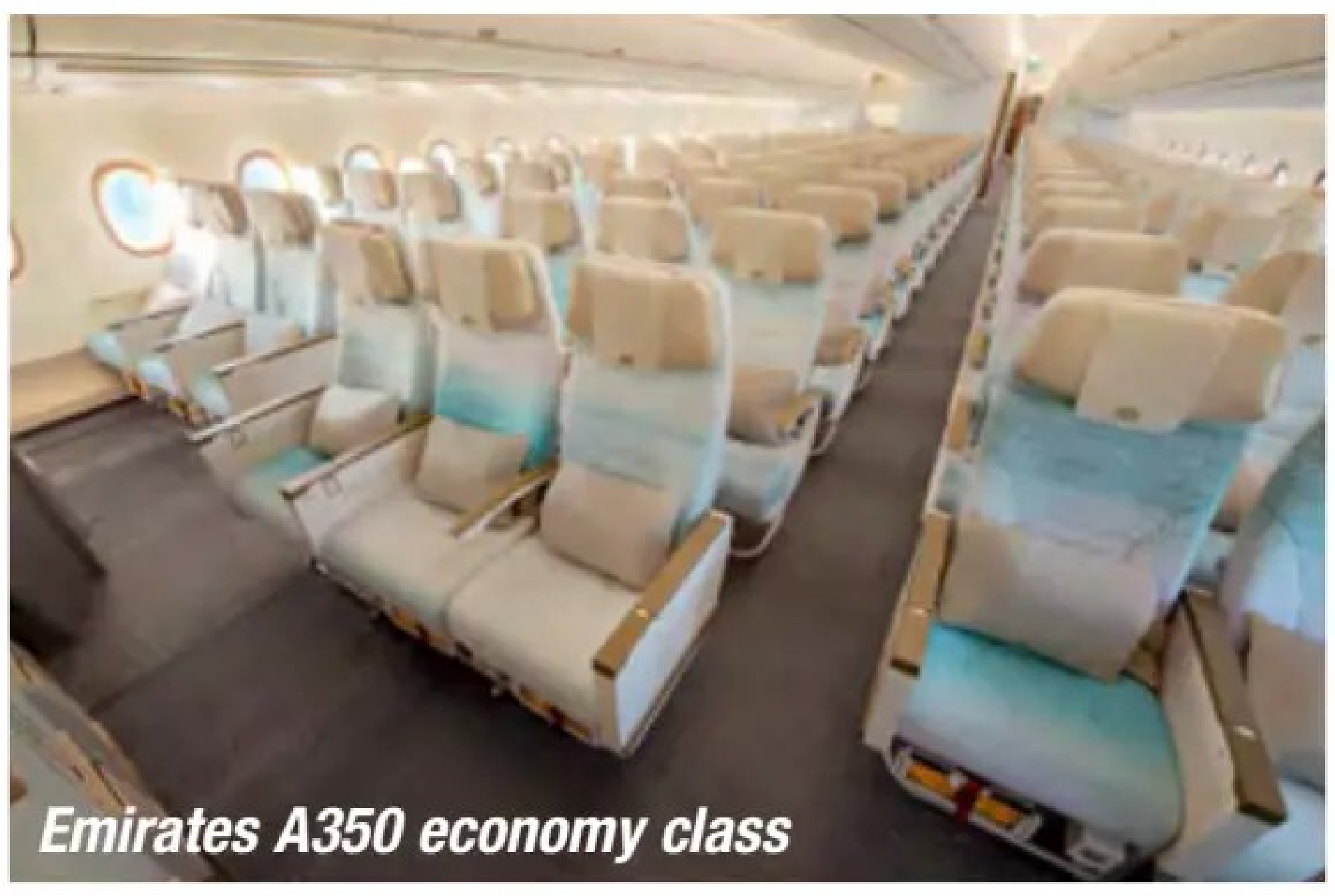
Whatever the outcome of Labour's SDR, there's likely to be further cuts and potential capability at a time when the UK needs to send a strong message to Europe and any aggressor that threatens it. **AI**

A6-EXA on stand in Dubai in November 2024
All images via Emirates

Emirates
A6-EXA

Emirates

finally receives its first A350



Emirates A350 economy class

Emirates formally took delivery of its initial A350-900 (A6-EXA msn 684) at Airbus's Toulouse plant on November 26, 2024. The aircraft's service entry was planned for January 3, 2025, nine days earlier than the previously announced January 14.

The airline reported: "The advancement of the scheduled service reinforces Emirates' commitment to providing customers with enhanced travel experiences and greater comfort on board."

Dubai-Edinburgh will be Emirates' first A350 route. The outbound EK 23 will depart at 1450hrs local time and arrive at 1905hrs local. The return, EK 24, will depart the Scottish capital at 2040hrs local and arrive in the Middle East at 0805hrs local.

The A350 will replace the Boeing 777-300ERs Emirates has used on the daily EK 23/24 since restoring the route in November 2024 after a four-year hiatus. The carrier operates 14 weekly flights to Scotland; the others are daily services to Glasgow.

Edinburgh Airport CEO Gordon Dewar said Edinburgh's direct connection to Dubai and onward connections through Emirates' network are "welcomed by both business and leisure passengers".

Emirates plans to introduce the A350 to Mumbai and Ahmedabad (India), Kuwait and Bahrain in February 2025, before Colombo (Sri Lanka), Bologna (Italy) and Muscat (Oman) in March. Further destinations will follow.

Emirates used the word 'advancement' in its press release about the first A350-900 route, but the twin-jet's delivery was several months later than initially planned.

The carrier had expected to receive A6-EXA in the summer. Bahrain was the first planned route (starting September 15, 2024), followed by Kuwait the next day. The Mumbai/Ahmedabad services were planned for October, with Edinburgh starting in November. Bologna, Lyon and Muscat were planned for December and Colombo in the new year.

In the end, the introduction of the A350-900 was delayed until later in 2024 and, subsequently, into early 2025. The deployment plan changed, and Edinburgh became the first route.

Emirates has yet to formally disclose the reason for the delay. Still, it is symptomatic of the widespread supply-chain issues to have seriously disrupted commercial aircraft production and deliveries in recent years.

When it announced its first A350 destinations in May 2024, Emirates said it expected to receive ten A350-900s by March 31, 2025.

Emirates said passengers flying the A350 could "look forward to the spacious and quiet cabin, high ceilings, expansive bin space and customised mood lighting designed to reduce fatigue and jet lag".

The carrier's A350-900s seat 312 passengers (32 in business class, 21 premium economy, 259 in economy). Emirates' deputy president and CCO Adnan Kazim said: "The A350 will be a game-changer for Emirates, enabling us to serve regional points with superior operating efficiency and flexibility."

Emirates has ordered 65 A350-900s. Although an order of the larger A350-1000 has long been anticipated, the carrier's president, Sir Tim Clark, said during the 2023 Dubai Airshow that the variant's Rolls-Royce Trent XWB-97 engine will need to be improved in durability.

MARK BROADBENT **AI**

AIRBUS A350-900
Emirates
F1RST
Emirates
A350

From left to right: HM Trade Commissioner for the Middle East and Pakistan Oliver Christian, Emirates president Sir Tim Clark, UAE Minister of Economy Abdulla Bin Touq Al Marri, Rolls-Royce SVP Customer-Middle East and Africa Omar Ali Adib, Airbus EVP Programmes and Services Philippe Mhun

RAF Hawks not meeting UK pilot training needs

The RAF currently has a fleet of 28 Hawk T2s in service, but the daily availability of airframes for pilot training requirements is not meeting the needs of the MOD
MOD Crown Copyright

A recent statement by the head of the RAF, Air Chief Marshal Sir Richard Knighton, at the Freeman Air and Space Institute on November 26, cast a damming view of the current state of the RAF's Hawk T2 fleet, which he described as outdated and unreliable. He added: "We don't get what we need from Hawk today – we get about half of what we should get out of it."

The current Hawk T2 fleet, which numbers 28 airframes, has been plagued with technical problems since 2022, which stemmed from issues with the Hawk's Rolls-Royce/SAFRAN Adour engine, in particular the compressor, which effectively reduces the engine's operational life by 50 per cent. The knock-on effect of this for the service is that fewer than half of the Hawk fleet is available for daily fast-jet training requirements for the RAF/Royal Navy, which are both under considerable pressure due to the length of time some trainee pilots are on hold, waiting to begin the next stage of their training.

Knighton continued: "Speaking quite frankly, I would like to replace the Hawk T2 as soon as we can to deliver a more modern, more reliable, greater capacity."

To reduce the delay in the UK's fast jet training pipeline, RAF and RN pilots are currently sent to either Italy or the US to continue training and avoid any 'skills fade' that would occur if they were to remain within the UK's pilot training system.

The Hawk T2's official out-of-service date is 2040. Still, Knighton is keen to bring this forward, as in his opinion, the entire programme should be the "pinnacle of our flying training", but based on current operational requirements and the availability of airframes, this is not the case.

Knighton continued: "Having a Hawk replacement means a more relevant, more reliable training capacity so that [RAF] pilots do not need to be sent overseas and would give the RAF the ability to train overseas pilots."

Concerns from within the RAF, by senior operational training staff, have raised the issue that the Hawk T2 may also not be a suitable platform to train future pilots for the future GCAP style platform, simply due to its age and availability, which is predicted to decline as the years go on and that the current T2 cockpit configuration will not be relevant for later fifth and sixth-generation platforms expected to enter service when the Hawk T2's will still be operational with the RAF.

A likely candidate to replace the Hawk T2 would be the Leonardo M346, which Knighton said would: "Give me the capacity to train overseas pilots here, and that's such an important… integral part of it."

But, while there may well be a need to replace the Hawk T2s, such a programme has no funding at present and the following recent defence cuts announced by Labour's Defence Secretary John Healey on November 20, it is unclear whether such a procurement for a replacement fast jet trainer is factored into the forthcoming Strategic Defence Review report, which is due shortly. **AI**

Commercial OUTLOOK

Supply chain challenges, digitalisation and technological change are all on the aerospace agenda in 2025. **Mark Broadbent** reports

Emirates
AIRBUS A350-900
XA

Emirates plans to start international services with the A350 early in 2025
Airbus

Emirates plans to start international Airbus A350-900 services with a Dubai-Edinburgh link on January 15, 2025. The carrier pushed back the entry into service (EIS) of the type from September 2024 because its first example, A6-EXA msn 684, was delayed.

The EIS delay typified the ongoing impact on airlines of the significant production delays that have seriously disrupted commercial airliner fleets in recent years.

Supply chain

A November 2024 McKinsey report reflected: "OEM production levels remain materially reduced, and aircraft and engine OEMs generated economic losses of about $2 billion in 2023."

Despite a glut of new commercial aircraft orders in 2022/2023, the industry's immediate post-COVID-19 pandemic bounce-back, surging passenger air travel and air cargo demand, widespread supply-chain issues, component shortages and labour constraints have prevented OEMs from attaining planned output increases.

Manufacturers have instead reduced output and deliveries. Airbus, for example, initially forecast 800 deliveries in 2024,

RIYADH AIR
طيران الرياض

> *"A particularly significant challenge for airlines has been the recall of Pratt & Whitney (P&W) PurePower Geared Turbo Fan (GTF) engines, after the discovery of contaminated powdered metal in PW1100G high-pressure turbine and compressor discs"*

but revised the figure downwards mid-year to 770 aircraft. It also pushed back a target to produce 75 A320s per year from 2026 to 2027.

Broadly, analysts do not expect the supply-chain disruption seen in the last couple of years to improve substantially in 2025. In its latest aerospace industry outlook, the consultancy firm Deloitte said "supply chain problems are likely to persist" and that "parts shortages and delivery delays, shipping costs and sourcing concerns are likely to continue impacting the industry."

PurePower egines

Meanwhile, newly delivered aircraft have had to be taken out of service for repairs due to quality issues. According to OAG, approximately 16% of the global airliner fleet was inactive and 7% was grounded for maintenance in October 2024.

A particularly significant challenge for airlines has been the recall of Pratt & Whitney (P&W) PurePower geared turbofan (GTF) engines following the discovery of contaminated powdered metal in PW1100G high-pressure turbine and compressor discs. Around 3,000 PW1100G-JM GTFs – the variant equipping Airbus A320neos and A321neos – require inspection and repair. Inspections are required every 2,800-3,800 cycles and engine disk replacements at 5,000-7,000 cycles.

Hundreds of A320neo Family jets worldwide were grounded at any given time by the issue, RTX said in 2023. In an update during the company's most recent earnings call in October 2024, RTX president and chief executive officer Chris Calio said: "At the end of Q3, our inspections of powdered metal parts continue to progress according to plan. At our maintenance, repair, overhaul (MRO) facilities, throughput of engines is improving. The team is utilising core practices to optimise the inspection sequence and implement concurrent assembly operations. We've now reached support agreements with 28 of our customers, covering roughly 75% of the impacted PW1100 fleet."

Responding to an analyst's question, Calio said: "I would say [we're] going to really start to turn the corner on the insertion of powder metal parts as we head into 2025." He said Pratt & Whitney is "putting in place continued capacity" to ramp up the rectification work in 2025, but he acknowledged that "a significant number of engines still remain that are awaiting induction."

Calio said capacity will be "a big part of what it's going to take us to power through this particular situation over a multi-year period. We've got to continue to get the material flow going again, try to get to a point in 2025 where that balance [of engines undergoing repair] has become less pronounced."

All the supply-chain issues have occurred at a time of rising demand – a double-whammy for some operators, whose new aircraft deliveries were delayed anyway.

Digital transformation

Deloitte expects aerospace companies "to focus efforts on improving their supply chain visibility" in 2025. It said: "This may entail more companies employing digital technologies to track the flow of materials from upstream suppliers (for example, Tier 2 and Tier 3 suppliers) to end users and help oversee supplier compliance.

"The industry is experiencing continued transformation, propelled by advancements in digital technologies, strategic investments and a renewed focus on workforce development and supply chain visibility. From talent to supply chain opportunities, aerospace companies are working to integrate digital technologies and artificial intelligence [AI] to address some of the industry's persistent problems.”

Recently, AI and machine learning (ML) applications have been adopted in aftermarket/MRO sectors for predictive maintenance. Deloitte predicts leading aerospace companies “will likely incorporate AI solutions into a more holistic approach to MRO considerations. We expect to see industry leaders evolve their digital applications for supply chain visibility to resolve issues ranging from parts and labour shortages to concerns with the quality and reliability of parts.

“In the workforce, the crunch is real, and frontrunners are expected to treat talent with the same attention as they do the production. In the realm of new products, the industry is likely to see several key players differentiate themselves through the operational flight of advanced air mobility and unmanned systems in commercial settings.

“The myriad technologies applied throughout the industry offer a plethora of opportunities for companies – ones that can help drive both margins and innovations for the future and seize the opportunities that lie ahead.”

OPPOSITE:
A new airline will start operations in 2025: Riyadh Air, which will operate both Boeing 787s and Airbus A320s
Riyadh Air

ABOVE:
Supercomputers will test Open Fan integration with aircraft in 2025
GE Aerospace

BELOW:
United Airlines will fly its largest transatlantic network in 2025
United Airlines

Artificial intelligence

Deloitte notes that the supply chain challenges affecting fleet availability means there is a growing call to extend the life of existing commercial aircraft. Another consultancy, McKinsey, recently noted: “Fewer new aircraft being delivered amid strong demand means that airlines are extending the service lives of their existing aircraft. The share of commercial fleet aircraft that are 25 or more years old increased to 9.6% from 8.1%.”

While supply chain issues create challenges, airlines keeping aircraft in service for longer presents opportunities. McKinsey said: “Companies are identifying value opportunities like integrating digital technologies to address the need for greater efficiency and cost-effectiveness with improved MRO services.”

This is accelerating the take-up of AI and ML for these tasks, according to Deloitte: “AI has seemingly become ubiquitous, potentially indicating that companies in the sector are growing more and more comfortable with the technology.”

In a survey of 67 aerospace/defence companies spanning the entire value chain, including ten aftermarket companies, Deloitte said 81% of respondents are already using AI/ML or plan to. It predicted: “In 2025, AI is likely to help accelerate progress in various areas, including enhancing aftermarket services and optimising supply chain.

“Predictive capabilities can help operators understand the operational flight schedule and balance the need for aircraft availability with maintenance requirements. Forecasting capabilities can help with inventory optimisation and reduce downtime, helping with resource allocation and overall efficiency.”

Deloitte noted that AI is now so sophisticated that MRO providers can calculate how long any aircraft could occupy a place in the maintenance hangar. Aerospace companies implementing AI/ML “will likely take a more global view of their operations and leverage digital technologies to plan out their work. Intelligent MRO operational planning can add predictability to sustainment practices, helping to ensure that aircraft are available when needed for the customer. Companies in the commercial sector will likely use intelligent MRO services to ensure consistent aircraft availability.”

Open Fan

An upcoming test in 2025 will involve GE Aerospace working with Boeing and NASA to model the integration of an Open Fan engine design with an aircraft. The project team will use the Aurora supercomputer at Argonne National Laboratory in Illinois and the Frontier supercomputer at Oak Ridge National Laboratory, Tennessee. These are the world's second and third-fastest supercomputers, both capable of crunching data at more than a quintillion calculations per second. According to GE, the tests will enable engineers “to study the aerodynamics of an Open Fan mounted on an aircraft wing in simulated flight conditions” and optimised for efficiency and noise.

Elsewhere on the technology front, ZeroAvia is targeting the end of 2025 for the certification of its first hydrogen-electric powertrain for a 20-seat aircraft. NASA, meanwhile, intends to begin flight-testing its X-59 experimental aircraft “in early 2025” for its Quesst programme to research quiet supersonic flight. The agency's Armstrong Flight Research Center recently completed an initial engine run on the aircraft.

The US Federal Aviation Administration issued its long-awaited special federal aviation regulations on aircraft operations and training for electric vertical take-off/landing (eVTOL) aircraft in October 2024. The two frontrunner developers, Archer and Joby, intend to achieve FAA-type certification for their aircraft in 2025. The companies also plan to offer initial eVTOL services in the UAE by the end of the year.

QANTASLINK

Deliveries

Boeing resumed airliner production in Washington State after a weeks-long strike by members of the International Association of Machinists and Aerospace Workers Union District 751 was resolved. Industrial relations are set to remain a key issue for the manufacturer in the new year when Boeing plans to cut its workforce by 10%. Media reports said nearly 2,500 layoff notices were sent to workers in various US states in autumn 2024.

Reuters reported that Boeing's quarterly losses surged to $6 billion in Q3 2024. Boeing's chief financial officer Brian West told the company's results call: "While we expect 2025 to be another use of cash, we anticipate a significant improvement over this year."

The ongoing FAA scrutiny of Boeing's manufacturing processes will continue. Certification and service entry of the 737 MAX 10 and MAX 7 variants is anticipated. However, Boeing once again pushed back the initial customer delivery of the 777X from 2025 to 2026, six years behind the original target date when the new Triple Seven was launched more than

> *“Carriers and operators are always having to adjust to challenges that are produced or affected by geopolitics”*
> Linda Jacques, Lester Aldridge

OPPOSITE ABOVE:
Qantas will introduce its first international A220 route, from Darwin to Singapore
Qantas

ABOVE:
Emirates will add more connections to Africa
Emirates

OPPOSITE BELOW:
A 2023 photo of an A321 in assembly. Supply chain issues are expected to remain a key theme next year
Airbus

a decade ago. *Bloomberg* quoted Sir Tim Clark, Emirates’ president, as saying he would be having “serious talks” with the manufacturer. At the time of writing, flight tests of the 777X remained suspended.

For Airbus, 2025 looks to be a year of building resilience in its supply chain, given the production increases on the horizon: 14 A220s per month in 2026, then 75 A320s per month in 2027 and 12 A350s per month in 2028. In its nine-month earnings statement issued in October 2024, Airbus noted that it is “actively managing specific supply chain challenges that may impact the ramp-up trajectory” towards these objectives. The company said these issues will affect the A350 “in particular in 2025.”

In 2025, Airbus is scheduled to hand over more examples of the A321XLR, the long-range version of the A321neo recently introduced to service by Iberia. Deliveries to American Airlines and Qantas are also on the agenda.

‘Perfect storm’

Air travel demand remains strong. IATA anticipated a record annual high of around four billion air travellers in 2024. EUROCONTROL said in October 2024 that “traffic [in Europe] is expected to grow by 3.7%, reaching 11.1 million flights in 2025. This reflects the 2024 outturn, an improved economic outlook and optimistic airline schedules for winter 2024-2025. Overall, traffic should return to pre-pandemic levels but with notable local variation.”

EUROCONTROL thinks “projections for 2025-2030 remain stable compared to previous estimates”. However, it noted: “The high level of uncertainty surrounding inflation, fuel prices, and global economic conditions could still impact future growth.”

As ever, numerous macro factors will influence the global airline business. “Carriers and operators are always having to adjust to challenges that are produced or affected by geopolitics,” reflected Linda Jacques, partner at Lester Aldridge. “As one issue is resolved, another appears.” Along with the volatile supply chains mentioned earlier, Jacques said there is a “challenging backdrop” for civil aviation heading into 2025. “Throw the push to green energy into the mix, and you have a perfect storm.”

Jacques cited “pressures on airspace corridors” given the restrictions on flying over parts of the Middle East, Ukraine, Russia and Afghanistan: “There is talk

of China becoming more aggressive in the South China Sea – and, if that happens, the air corridors will get even smaller, which will put even more pressure on air cargo capacity. We will likely see more carriers come under financial pressure as geopolitics affect air travel."

Networks expand

Despite the challenges, major airlines worldwide are firmly positioned for growth. This is evident when looking at the route plans of major carriers worldwide. For example, United Airlines' summer 2025 schedule includes services to eight new cities, including Ulaanbaatar in Mongolia and Dakar in Senegal. The airline will also operate its largest-ever transatlantic schedule, with more than 760 weekly flights from the US to over 40 European destinations.

In Europe, the Lufthansa Group announced in November 2024 that it will connect 300 destinations worldwide with more than 12,000 weekly flights from its airlines' hubs in Germany, Switzerland, Austria and Belgium in the summer of 2025.

Qantas plans to restore two more Airbus A380s to its fleet in 2025. The airline is optimising its schedule to "support growing customer demand in key Asia Pacific and US markets." For the first time, Qantas will also fly Airbus A220-300s internationally on a new route from Darwin to Singapore.

Emirates will increase frequencies in the Persian Gulf to various African points, including Addis Abba in Ethiopia and Johannesburg in South Africa. Meanwhile, Etihad Airways will introduce ten new destinations.

Riyadh Air

In the Middle East, there will be a new name in the skies in 2025:Riyadh Air. This new premium international airline based in Saudi Arabia recently placed a firm order for 60 Airbus A321neos and 72 Boeing 787-9 Dreamliners in 2023. The carrier describes this fleet size as "unprecedented" for an airline start-up.

When the Airbus order was announced, Yasir Al-Rumayyan, the Saudi Public Investment Fund governor and Riyadh Air chairman, said the new carrier had "ambitious intentions" to build a comprehensive international network and establish Riyadh "as a major strategic global aviation hub."

Riyadh Air CEO Tony Douglas told Reuters in October 2024 that the airline is now planning to start talks with Airbus and Boeing about an order for an A350-1000 or 777X widebody aircraft. Riyadh Air aircraft will be painted in one of two liveries based on the colours of indigo and lavender. At the time of writing, the carrier's initial routes and a more specific timeframe for when it plans to begin flights were both undisclosed. **AI**

ABOVE: ***ZeroAvia is targeting the end of 2025 for the certification of its first hydrogen-electric powertrain*** ZeroAvia

BELOW: ***NASA, meanwhile, intends to finally begin flight-testing its X-59 experimental aircraft "in early 2025" for its Quesst programme to research quiet supersonic flight*** NASA/Carla Thomas

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ARMÉE DE L'AIR DE L'ESPACE
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Ready in anticipation

The Armée de l'Air has flown the H225M Caracal in multiple conflict zones around the world, and this has only further boosted sales of this high-capable platform for Airbus

All images Airbus Helicopters/Anthony Pecchi

The H225M Caracal is steadily becoming the helicopter of choice for operators seeking a multi-mission, configurable platform that can switch from delivering Special Forces teams deep behind the lines, to search-and-rescue missions within a maritime environment. **Glenn Sands** spoke with Michel Macia, Head of the H225 Programme for Airbus, on the helicopter's success

Airbus has been working steadily on developing the H225, part of its Super Puma family, for more than a decade and, in the process, has made it the preferred, reliable choice for customers worldwide. The company already has plans in place to continue making the variant into 2040, as Airbus firmly believes there will be demand for the platform. The success and the potential that's still to come with the aircraft is endorsed by Michel Macia, Head of the H225 Programme, who tells *Air International:* "We have worked hard to make sure the H225 is the preferred and reliable choice for the customer. That has been our ambition, and it has not been by chance, it has also been by the way we have – and are – investing in the product."

This method is proving a success, and the current outlook for H225M orders is anticipated to be around 70 aircraft signed by late 2024, with sales to the Japanese Coast Guard, the German Federal Police (Bundespolizei), Hungary, Iraq and recently, the Netherlands. Along with a highly capable platform, it's the experience of knowing what the global market requires that has also led to the success of the H225M. According to Macia: "Experience comes from us [Airbus] having delivered more than 1,100 helicopters which have accomplished six million flight hours, which works out to more than 130,000 flight hours per year.

"If we look at the H225 specifically, we have more than 350 examples in service, which are currently operating everywhere in the world in all environments."

With the helicopter regarded as a dual platform by all those that currently and intend to operate the type, which is a business model Airbus has followed across many of its products, not just the Super Puma family. Macia explains: "The fact that we are civil and military certified brings flexibility to the customer, which also extends to when we are repurposing the aircraft to move to another customer, or from one sector to another, when necessary. It's value for money for the operator with their initial investment because the platform is so flexible.

"If you check the global sales market now for this aircraft type, there are very few, which means the aircraft has maintained a high sales momentum. For Airbus, it's simply not an issue to repurpose this aircraft from one side to the other, from military to civilian.

"In addition to the helicopter's flexibility is the performance of the H225. For example, the French Army flew an 11-hour mission with the Caracal using its air-to-air refuelling system. So, for us at Airbus, we know the aircraft is able to conduct long-range missions in a hostile environment when necessary."

LEFT:
More than 350 H225/H225Ms are currently in service, with the fleet achieving more than 880,000 flight hours

While the performance of the H225M has been vitally important to Airbus, an area that the OEM continually strives to increase, Macia is keen to point out that much focus is given to the missions and how the platform can stick to and achieve these needs.

"In the case of the Netherlands, we had been talking for a long time with them to define exactly what they require and ensure we could customise the H225M's mission fit to this requirement. Every customer is different, and for this, we're able to tailor mission suites within the H225.

"It's in our DNA at Airbus to understand the customer's need and prepare the aircraft that meets these needs. The customisation, as on the H225, is part of the business model. For example, with the Black Hawk, you cannot customise it exactly to one's needs. You have some options from a picking list supplied by Sikorsky, but it simply means that you can't customise the platform specifically to your requirements. It will be close, but not exactly. Our strength is to take a civil-certified platform, bring it into the military market, and customise it. But you have to remember, it's not only the military sector, but the Bundespolizei too, which is within the civilian market but very specialised. We're able to adapt the H225M."

Macia views the process of developing the H225M in two parts. It has developed a business model that reflects this in terms of sales for Caracal and believes further sales will be made within the energy sector and public services with the aircraft.

"We can cover all operations, such as SAR and medevac, and military mission requirements, such as special operations. It's about knowing and exactly meeting the needs of what the customer wants from the aircraft," he says.

Given the specialisation of some variants of the H225M, Airbus is keenly aware of the need to ensure that the build process is as smooth as possible, along with meeting the customer's specific requirements on time, which Macia views as the other part of the whole process. He states: "When speaking with the customer, we're also anticipating what their future needs might be, such as whether they will be looking to renew their existing fleet. The H225M platform is constantly evolving, and the entire programme has a continuous yearly improvement policy.

"It's not about making one big jump, but each year developing the aircraft that bit further, which we are currently investing in."

One of the areas that Airbus has focussed on is making the platform more cost-effective and easier to maintain, what Macia refers to as "value creation for the customer". He continues:

"Our way of customising and integrating specialist systems is a puzzle of different missions. However, we usually have very few customers asking for a specific type of mission. With many, they are acquiring the aircraft to perform multiple styles of mission. We have had customers buying the H225M, having looked at 50 different configurations before selecting the platform. It's about offering value to the customer, so they have that unique asset."

Airbus continues to invest in the maintenance plan for the H225M, making the complex systems onboard simple to maintain in the field if necessary and reducing the overall manhours needed per flying hour.

Macia explains: "We are really focussing on any issues that customers may be experiencing with the H225 and have set up a customer focus group in each of the different regions of the world. We have looked into any maintenance problems

they may be having, and each year we are reducing the number of critical items we have on the maintenance side. One example is that this year, we will extend the gearbox's TBO [time before overhaul] by 20%, allowing the customer to extend the life of major components.

"Another example is we [Airbus} are working hand-in-hand with the customer in terms of their dealing with maintenance schedules, but we're also looking at the reliability of the H225 and the whole support concept for them. We're asking 'are you getting the flight hours you expected? If not, why not? How can we help you?' Additionally, we can provide maintenance support if the customer requires it; we can support training or develop a dedicated maintenance place tailored to their requirements. We have a different contract for parts that can be customised for the customer. So, we are really focussed on ensuring that they get the flight hours for the platform in terms of their mission requirements. We ask, 'Do you need to have the aircraft ready every morning at eight o'clock?' or 'Or do you need seven hours of flight time during the day?' 'Or do you do just seven hours in a week?' We have developed a two-concept approach to provide this level of support to H225 operators.

"One is a military support centre that we are extending step-by-step to more and more customers. It's composed of a multi-functional team inside of Airbus that provides support from the initial design stages through to operational support," Macia continues:

"I see this as the front office for the customer when they contact us, as we have a lot of subsidiaries around the world, so we have a big network. Part of this is the front office of the subsidiary. The other part is in what I call the back office inside Airbus. Daily, both the front and back offices are in touch to ensure we are monitoring the mission requirements and needs of the customers and facilitating all the necessary tasks, ➔

BELOW:
Airbus Helicopters has invested in modernising the H225 to match customers' evolving mission requirements, bringing it to the highest safety standards and reducing its time to market

F-ZWDU
ARMÉE DE L'AIR & DE L'ESPACE

ABOVE:
Hungary purchased a total of 16 H225Ms from Airbus. Their first deliveries began in July 2023. The nation was the second NATO member to introduce the type into frontline service

LEFT:
The Caracal can be armed with 60mm or 70mm guided and unguided rockets

RIGHT:
On either side of the lower fuselage, the Caracal can be fitted with 12.7mm gun pods

whether short, medium, or long-term plans. An example of a long-term strategy is when a customer says they want to have a 10,000-flight-hour plan, and today, they may only have one for 8,000 hours. They will ask us for help to devise a six- or seven- eight-month plan to achieve this. We will join with the customer to ensure that they reach this expectation. Such practices have proved the worth of the military support centre.

"We're now developing the same procedures, which we started this year, for the civil market; it's what I call a 'feed centre' where they can contact us regarding their H225." Macia adds: "Yes, we have a customised product, due to the number of different configurations for the H225M Caracal, so we have a customised support capability for the customer."

With such a specialist and complex aircraft, safety is at the very heart of the H225 for Airbus, according to Macia: "What we wanted in the development of the aircraft is to prevent an issue from occurring, even if we think it will never happen. So, we have established a large 'safety barrier' with the H225 that prevents incidents from happening. We have ensured that the H225 is certified at a higher safety level than simply the regulation states. And to achieve this is down to the technology we've put into the aircraft and its design."

Airbus set up an entirely new infrastructure for the assembly of what it refers to as 'dynamic components', such as the H225's gearbox, which saw the establishment of new facilities to 'bench test' this component, Macia explains: "We have had bench testing available in the past, but now we have a completely new, dedicated building specifically for this type of test. So, we can test under different conditions and for a longer time, for instance, demonstrating endurance, which we do beyond the required standard certification.

"We've also introduced new processes for cleaning the component assemblies, and alongside this, focus on reducing the human risk factor on the maintenance side. We assembled a group of H225 customers and asked them the critical maintenance tasks. Their answers allowed us to develop and review our maintenance cards. In addition, we innovate the practices by providing a video to explain necessary procedures. It could mean having new warnings in place for an operator or the person performing the maintenance. We could review the design of the part, and we can say that this component is too complex to maintain, so we'd look at altering the design of that component if necessary. Another option is to have some specific training online for an operator.

"We have also adopted aspects of the safety practices into our logistics set-up. Particularly how we transport dynamic components, making sure that they are moved within the specifications we request. For instance, vibration detectors are now placed on some of the boxes and turn red when there's a problem with them during transit. If there is, we need to investigate. It's a global procedure that we have adopted."

The vibration monitoring system is not only restricted to when components are being transported. The new internal design of the H225's gearbox is a vibration monitoring system, which means the operator and Airbus, which has a global connection network in place, can detect any fault with the component before a serious issue develops. As Macia explains: "It's about changing the rules with the company and innovating new techniques both in the product development and support sides for the H225."

Given Airbus's demand and specialised requests regarding the H225, *Air International* asked Macia how the company manages its core industrial set-up.

"Customer expectation can vary greatly as to when they want the aircraft. Sometimes, they wish to use the H225 within four months; for others, it can be six years.

"We receive very different requests; it may be that a customer simply needs the aircraft for one or two types of missions; for others, it may be a significantly different configuration they request. So, our industrial set-up needs to be flexible enough and big enough with regard to the engineering side to meet these needs." Macia continues: "We make sure that the concurrent engineering side works in parallel with the other process taking place on the aircraft, so we have the right process in place to fit with the customer's expectation.

"It has to be remembered that this is not a brand-new aircraft, but we have digitised the H225 completely, allowing us to work in 3D-style conditions and a faster design process. We've also used virtual reality in the process. So, when we design a new component, we can put ourselves in the customer's shoes."

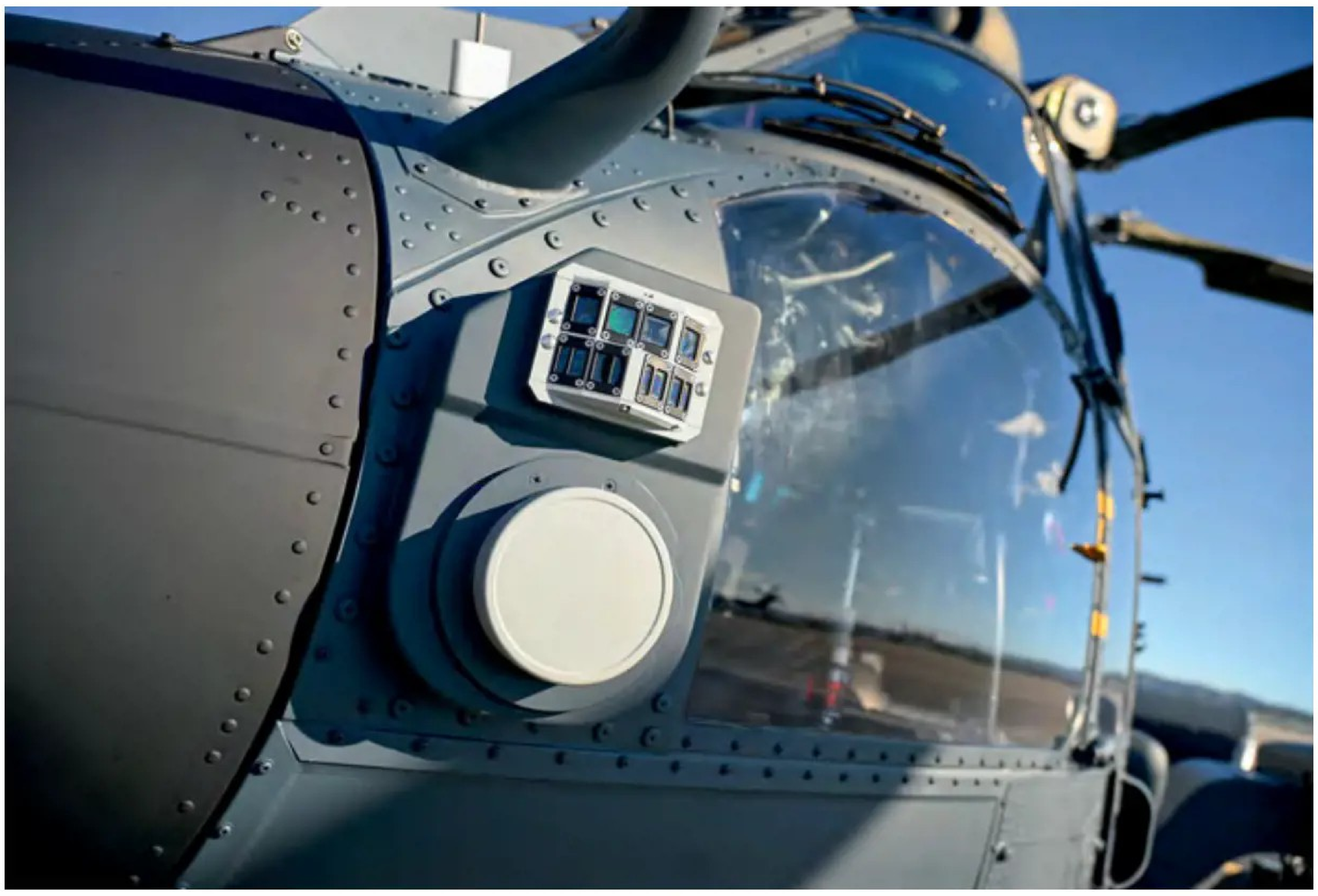
Airbus has also embraced 3D printing on the H225, which has significantly eased the time and development of mission-specific components, according to Macia. Artificial intelligence is slowly finding its way into the platform's development. "It's a lot of money to invest, and we expect the H225 to be in service beyond 2040, and we want to be long-term partners with our customers. We don't have a deadline for the aircraft; if we see a requirement and invest in the right way, the customer base will continue to grow for the H225M."

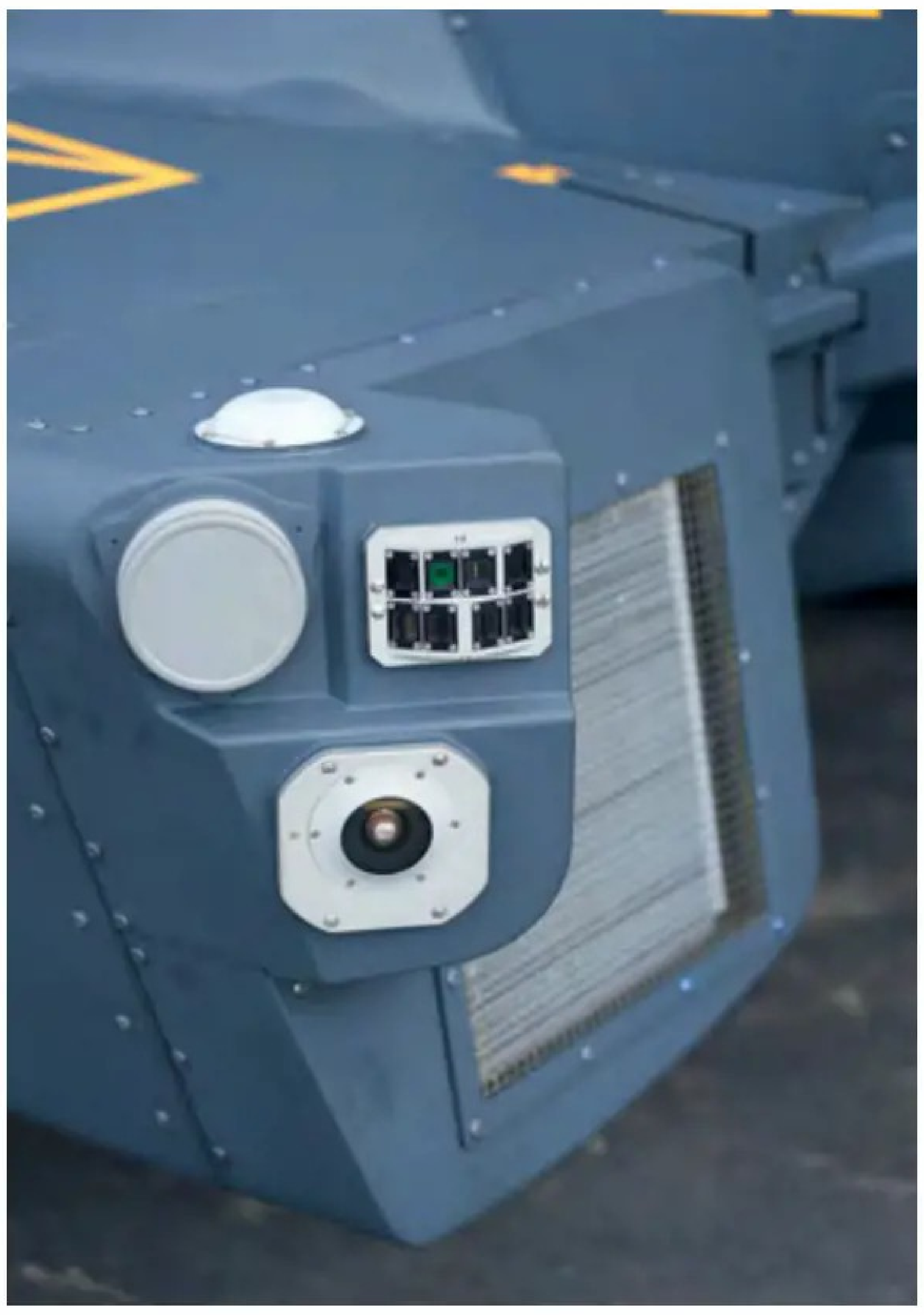
The complex nature of the battlespace has meant that connectivity reigns supreme, with pilots expected to be able to receive and send data while inflight. Airbus has wasted no time in ensuring that such capabilities are part of H225M Caracal's operating suite, as Macia explains: "Connectivity is key, and customers want the aircraft to be connected by satellite, and we want them to have the interoperability between different aircraft and platforms within a battlespace. It's a specific requirement for NATO platforms.

"In terms of mission planning, it's critical. With Special Forces on the ground, they want to be able to inform the aircrew that the mission is complete and they need picking up. It can be as simple as that in some cases.

"With connectivity comes cyber-security, particularly when looking at military operations; it needs to be secure; it's an area we are working on now."

BELOW:
Airbus is set to continue production of the H225 beyond 2040. The model will remain Airbus Helicopters' heavy platform for decades to come





TOP LEFT AND RIGHT:
The H225M is equipped with a radar warning receiver, missile approach warning system, laser warning receiver, and chaff and flare dispensers

Military customers choosing the H225M Caracal are getting a platform that can, when necessary, adapt to civilian-style missions, such as fire-fighting or search and rescue (SAR). It's an aspect of the helicopter that Macia is very proud of with. He explains: "We can customise the aircraft to any military requirement with all the constraints they may have. As a company, we take the time to understand the exact requirements. We are not discovering something new. When a customer asks us [for] a requirement, we already have something in development or have developed a system that may be performing that mission somewhere in the world already. This adds to the overall strength of the platform.

"Investment is continuous, and one area we are looking at is offshore, where if the Sikorsky S-92 does not meet operators' requirements, we will be able to offer a suitably configured platform. Investment has not stopped in the H225."

Returning to the H225's recent military sales success, *Air International* asked Macia for details on his view regarding the Netherlands' announcement that it has ordered 12 H225Ms for its air force.

He told us: "The French have demonstrated that you can operate the Caracal anywhere and perform any mission. Through operations, they [the Armée de l'Air] have shown that you can do whatever you want. It's simply the best asset that's out there.

"The Netherlands had its specific requirement, different from the French Army. We worked with them to develop an airborne communication system to their specifications and a weapons system they requested. It was a case of building on the experience of the French production line and tailoring requirements to what the Netherlands requested specifically to this."

➔

Asked about the H225M Caracals that are due to enter service with Hungary, Macia was not able to go into too much detail, but he did state: “Having previously operated Russian aircraft, the move to Western aircraft offers a very different level of safety and the possibility to perform different missions than they had been able to accomplish previously. With this contract, the challenge for us was to move from the philosophy of the Russian aircraft to that of Western platforms. The safety approach, as is the interface between the pilot and the aircraft, is very different. There’s much more time spent monitoring the aircraft’s navigation systems than constantly checking the parameters of the aircraft when in flight. It’s a much higher degree of integration between the flight crew and the aircraft. Additionally, the H225 is not specific to just one mission, and the Hungarians have already recognised this and intend to fly both military and civil missions when necessary.”

In some ways, it indicates how capable the H225M Caracal is in service with the Armée de l’Air. What has been accomplished and the sheer variety of missions flown, according to Macia, also mean that via Airbus, potential customers for the Caracal, have been put in contact with Armée de l’Air squadrons flying the H225 and, on occasions, visited bases and operational areas to see the capabilities they could potentially acquire. Macia is keen to point out that the Armée de l’Air has been very supportive when asked by the OEM.

With such a competent and respected platform in their hands, Airbus can be justifiably proud of the H225M Caracal, and perhaps the best to comment on this is Macia, as programme head: “I will not send an aircraft like this to a customer if it’s not what they need to meet their mission requirements. At Airbus, we have a large range of aircraft, and if they’d be better suited to the Super Medium class, then I would suggest that. So, if you approach us to buy a helicopter, we will first ask, ‘What’s your requirement?’ It’s then deciding how one of our platforms meets this and ensuring, as in the case of the H225M, that if a customer’s mission requirements evolve over time, then so can the Caracal through different mission kits, which may be for an operational career of up to 20 years.

“I see that the customer is not buying an aircraft but a platform that can perform different missions in the future that they may have yet to even think of when they purchased the Caracal. It’s not by chance that we are reaching 60-70 signed contracts; it’s because we have invested a lot in the aircraft to make it a true multi-role platform for customers.” **AI**

ABOVE:
The Netherlands has ordered 12 H225Ms, gaining significant experience with their H215M Cougars in multiple operational mission environments. The Caracals will be a substantial leap in capability, allowing for long-range Special Operations-style missions to be performed

BELOW:
HForce is the latest generation of Airbus’ weapon system. It is unique, flexible, and designed to meet the requirements of military operators seeking light attack mission capabilities. It offers a wide range of modern weapons and is easy to operate – with a level of targeting accuracy formerly reserved for high-end attack helicopters. The H225M is capable of utilising HForce

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Sikorsky's Black Hawk still in the fight

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101/25

The court-enforced scrapping of plans to create a new national carrier for Nigeria is the latest in many problems for the country's airline sector. **Alan Dron** examines the reasons behind the current crisis

On the

The UK's Virgin Group ran a Nigerian offshoot early this century but pulled out after five years
Virgin Atlantic

brink

Nigeria should have a flourishing national flag carrier. By far the largest country in Africa, with a population of around 235 million and the continent's most significant market economy, Nigeria would seem to have everything in place for an airline to represent it successfully worldwide. This is especially true as millions of Nigerians work and live abroad, creating a ready-made diaspora that wants to travel home regularly to visit friends and family.

It has not had a national airline for more than a decade. The latest attempt to create one has fallen at the last hurdle in the past few months due to protests from other Nigerian airlines.

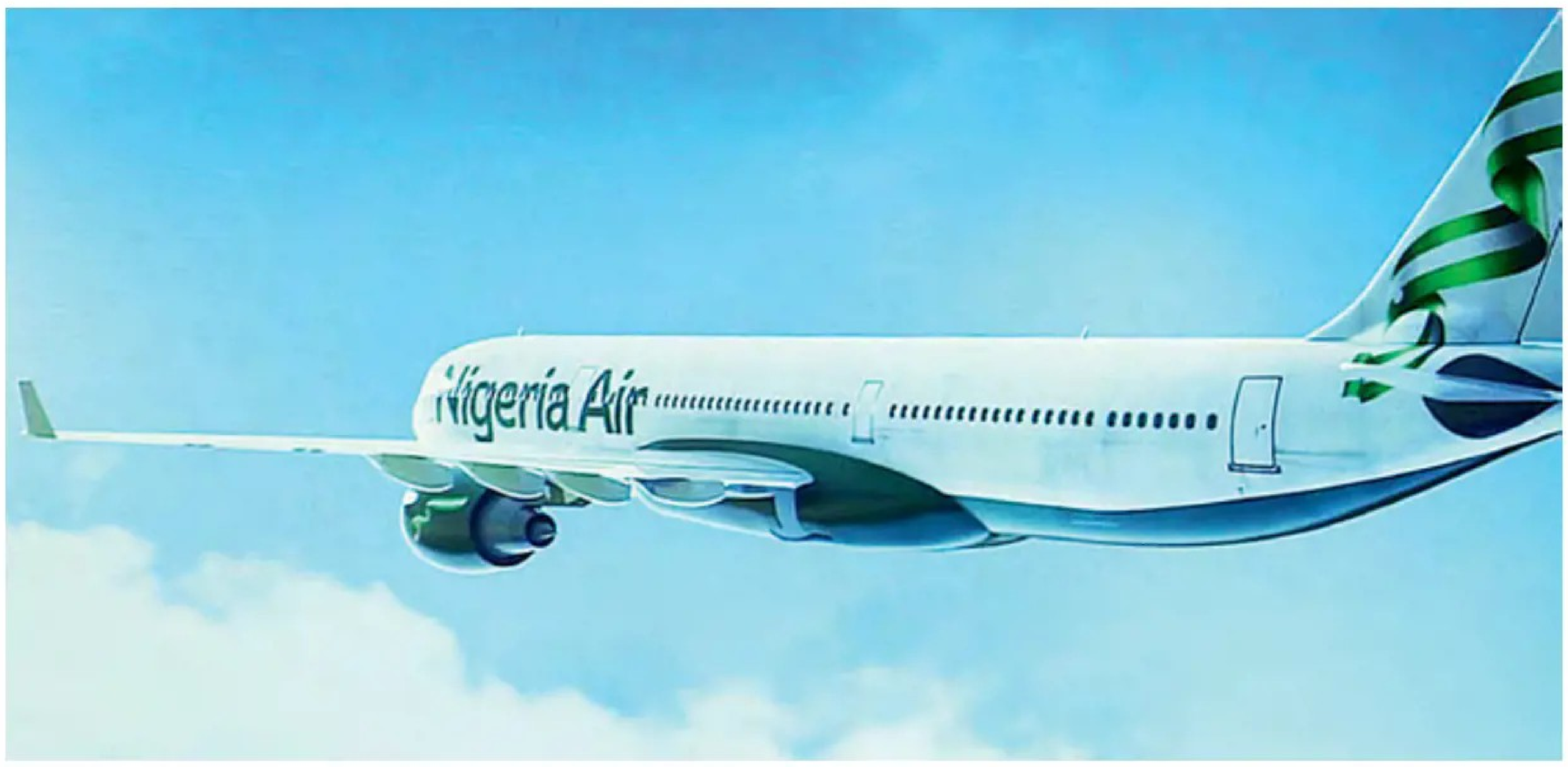
It was not always this way (see panel on page??). But the past decade has, frankly, been a mess.

In an attempt to restore the country's position in the global airline business, Nigeria's government announced at the 2018 Farnborough Air Show that it planned to create a new national carrier, Nigeria Air. Nigeria's then-president, Muhammadu Buhari and his energetic aviation minister, Senator Hadi Sirika, championed the project.

Setting up a new airline is never a quick process, and progress was slowed further by the Covid-19 pandemic, but by 2022, it appeared that things were finally coming together.

In a break from tradition, the government announced that the new airline would have a major foreign backer – in this case, Ethiopian Airlines.

The choice of Ethiopian Airlines was a smart one. The Addis Ababa-



CLOCKWISE FROM BELOW:

Overland Airways is typical of the small Nigerian airlines that operate mainly domestic and some regional routes to neighbouring countries
Embraer

One of the most tangible signs of the long-planned but ultimately abortive Nigeria Air was this rendering of an aircraft in the planned livery
Nigerian government

Green Africa has a fleet of three ATRs but currently operates only two. All of them have an average age of around 12 years
Green Africa

Air Peace has recently become the de facto national carrier in the wake of the Nigeria Air debacle
Embraer

based company is widely regarded as the continent's most successful airline. Although a state-owned entity, the Ethiopian government is strictly 'hands-off' when it comes to its national airline, allowing management to get on with the job of running operations without political interference. The airline's success can be seen in its contribution to no less than 7% of Ethiopia's GDP.

The deal for the new Nigerian airline: Ethiopian would take a 49% stake, with 46% being held by Nigerian investors and the Nigerian government holding just 5%, with the intention of cutting its small stake to zero once the company was firmly established.

That's where problems started. Some quarters were concerned that the Nigerian government was effectively allowing Ethiopians to stroll into the potentially vast Nigerian market and extract money that should stay inside the country.

Politics regarding business in Nigeria are rarely far from the surface. This concern eventually crystallised into a court case brought by Airlines of Nigeria (AON) – a grouping of Azman Air Services, Air Peace, Max Air, United Nigeria Airlines, and Topbrass Aviation – that went to court to seek a legal block on the whole project.

This came as the new airline was on the verge of taking off. It had received its AOC from Nigeria's regulator. Ethiopian had painted a Boeing 737-800 in the new airline's colour scheme and shown it off in-country. It planned to transfer to the fledgling carrier around seven Boeing twin-jets, plus three 787s for long-haul routes.

Ethiopian told Nigerian newspapers in March of this year that they had received the first three Boeing 737-8s from Boeing for the new enterprise before the project fell apart.

One source closely involved in the project, who requested anonymity due

ZS-XZD
green africa
ATR72-600

to ongoing court cases, commented: “This would be the international airline that Nigeria wants and needs.” He noted that foreign carriers flying into Nigeria were operating with full aircraft, “and they charge an arm and a leg.”

Remarkably, however, AON managed to convince a judge at Nigeria’s Federal High Court, firstly to temporarily halt the process and then, in August this year, to order that the entire project be scrapped. The airlines argued that politics and personal interests marred the process and that it would be detrimental to Nigerian airlines and the public interest. AON hailed the court’s decision as a victory against the self-interest displayed by the previous government.

In a statement issued after the final verdict, AON president Alhaji Abdulmunaf Yunusa Sarina said: “The bold and patriotic Declarations and Orders made by the court today leave no one in doubt that the entire bidding, approval, and so-called unveiling processes of the purported national carrier were nothing other than a sham set up to hoodwink Nigerians.

“It was also a surreptitious plan to kill Nigerian indigenous airlines and hand over the common wealth of Nigeria’s huge aviation market with over 85 Bilateral Air Services Agreements (BASA) around the world to Ethiopian Airlines through the back door without investing a penny into the Nigerian economy and in an attempt to satisfy the whims and caprices of some selfish and unpatriotic individuals.”

Quite why the Nigerian government of the time would have wished to kill off its own country’s existing aircraft was never explained.

Getting to the bottom of what caused Nigeria Air’s failure to launch is complex because several legal cases are underway in the aftermath of the debacle. As is common in African politics, there are accusations of corruption. A significant factor behind the project’s collapse was the installation of a new government under president Bola Ahmed Tinubu and his aviation minister, Festus Keyamo, who did not share their predecessors’ enthusiasm for the proposed new national carrier.

EMBRAER
HELEN EKWUSI ONYEAMA

Understandably, Ethiopian has said little on the affair but is known to be deeply frustrated at wasting the time and money it devoted to bringing the new flag carrier to the verge of revenue operations.

Other factors behind the dropping of the project include the dire state of the Nigerian economy. The country’s currency, the naira, has been allowed to float, which has caused inflation. As the naira lost ground against the dollar, in which most international aviation prices are calculated (for fuel, leasing costs, and overseas maintenance, for example) this has made it difficult for the country’s airlines to remain stable, far less grow.

The underlying problem is that a large percentage of the country’s GDP is used to pay interest on its debts, leaving little money for infrastructure or aviation.

This is a major problem because aviation is – or should be – the backbone of transport in Nigeria, both because of the country’s size (more than twice as large as California) and because roads are not always safe.

However, a glance at the country’s airline scene shows that it is served by just seven small scheduled airlines, several of them in poor economic health.

One reason for this is that many of them are owned by private individuals. They tend to be powerful and rich… but not rich enough to consistently fund an airline and provide investment to allow it to grow.

This means that the airlines have small fleets of increasingly elderly aircraft. Spares and maintenance for the

Ibom Air
C-FOYA

CLOCKWISE FROM ABOVE:
Ibom Air, supported by the Akwa Ibom regional government, is a relative newcomer to Nigeria's airline scene. It plans to build a fleet of 11 Airbus A220-300s
Airbus

Typical of the small carriers that make up the Nigerian airline sector at present is Green Africa, which has a small fleet of ATR 72-600 turboprops for regional flights
Green Africa

Arik Air, whose fleet extended from regional jets such as this CRJ700 to Airbus A340s for long-haul services, was Nigeria's flag carrier until a government entity took it over due to chronic debts
Bombardier

old aircraft are exorbitantly expensive, reducing the funds available to invest in new aircraft.

Additionally, the increase in airline costs has led to corresponding increases in ticket prices, making it more difficult for many people to fly and thus reducing the airlines' income, exacerbating their cash problems.

Nigerian airlines need investors with an extended vision who are prepared to fund larger fleets – say 20 to 30 aircraft, deemed the minimum fleet size for a successful airline. "If you don't have more than $250m and 15 aircraft, it's not going to work," said one close observer of the country's airline sector.

However, in the past, private investors often started operations with at least three Nigerian regulator-demanded or regional aircraft that needed to be bigger to achieve a sustainable profit margin. All too often, they collapsed, tarnishing the reputation of the entire sector.

That pattern is continuing. Six or seven new airlines are currently applying to start operations, all with a minimum of three aircraft.

The sole exception at present is Air Peace, which has around 30 aircraft and has effectively taken over as the country's flag carrier. One problem it faces, however, is that it is not a member of one of the three global airline alliances (Oneworld, SkyTeam and Star Alliance) and, without partners onto which its passengers can transfer at foreign hubs, is not a particularly attractive option – unless on point-to-point routes such as Lagos-London, where the large number of Nigerians going back and forth helps keep load factors up.

When flying within the African continent, passengers with a choice of airlines are more likely to choose an airline such as Ethiopian, with which they can earn frequent flyer miles and, more importantly, access to a global network.

Foreign airlines operating into Nigeria are usually full and can charge high fares. The market is there if only the structural conditions of the Nigerian airline sector can be changed to make home-grown airlines more viable. "Nigerians will fly Nigerian airlines as soon as they are offered nice aircraft," the source commented.

Ironically, despite the problems faced by domestic carriers, "There are many extremely smart, good airline managers in Nigeria, but they face these major difficulties," he added. "Similarly, there are many proficient Nigerian pilots and mechanics. However, with internationally recognised qualifications, many move abroad to work, working for Middle East, Indian or Chinese carriers."

So, what hope is there for Nigeria's airline industry? There is a new, stricter Nigerian Civil Aviation Authority, bringing in European regulations and a modern IT system, EMPIC, to oversee all aviation licenses and permits and help the country's airlines comply with international regulations. This will eventually improve the country's airline industry and bring positive recognition abroad, enabling Nigerian airlines to get all-important landing permits in foreign countries.

Additionally, there is a possible new route to bringing start-ups to market. In the past two years, three regional governments have launched or announced plans to launch airlines within their territories.

The furthest advanced is the Akwa Ibom region, in the country's far south, whose local carrier, Ibom Air, unusually for Nigeria, has a relatively young fleet of five Bombardier CRJ900 regional jets and two – of an order for ten – Airbus A220-300s. The second A220 to be delivered is an additional, 11th aircraft leased from Carlyle Aviation to meet what Ibom Air said was demand for flights outpacing the company's delivery schedule from Airbus. The A220s are expected to replace all the CRJ900s eventually.

Ebonyi, Bayelsa and Anambra states have announced plans to establish regional carriers. Whether these come to fruition remains to be seen. State-owned airlines would move away from the past practice of wealthy individuals funding airlines. Still, the risk remains that changes in a state's policy or personnel following elections could cause the plans to be ditched.

There appears to be no easy solution to Nigeria's transport travails. **AI**

What's in a name?

Until 2003, Nigeria had a long-running national airline, Nigeria Airways, which had existed since 1958. The gap following its demise was filled by Virgin Nigeria, an offshoot of the UK-based Virgin Group that operates Virgin Atlantic, combined with Nigerian investors in the new company. This lasted for around five years before Virgin pulled out because of a combination of local competition and – significantly – local political interference from the Nigerian government.

The company was briefly renamed Nigerian Eagle, then Air Nigeria before the latter finally collapsed in 2012.

No new official national airline was appointed, although existing company Arik Air became the country's de facto flag carrier until financial difficulties and debts saw it taken over by a government body, the Asset Management Corporation of Nigeria (AMCON), in 2017. The airline has slowly withered on the vine since then and is a shadow of its former self. At the time of writing, it flew only three aircraft.

A full-service FUTURE

Air Astana has extended the range of its A321neos to fly Kazakhstan-London nonstop

All images via Air Astana, unless stated

Since arriving in Kazakhstan in 2005, Peter Foster has focused on building Air Astana into a high-quality, safe, and profitable airline group. **Michael Doran** recently visited the Central Asian nation to learn more

EI-KGB
AIRBUS A321neo

air astana
EI-KIB
AIRBUS A320neo

> *"Air Astana has done well, and we are a good, profitable airline, but I think we are too much of a local carrier, and we need too much more of a regional and global carrier"*
>
> Peter Foster, Air Astana Group President, and CEO

The Air Astana Group is the largest airline in Central Asia and the Caucasus regions in terms of revenue and fleet size. It operates short- and long-haul flights on domestic, regional, and international routes across these regions and in the Far East, the Middle East, India, and Europe.

The Kazakhstan-based Group includes Air Astana, a full-service airline founded in 2002, and FlyArystan, a low-cost carrier launched in 2019. In February 2024, the Group was listed on the London Stock Exchange, Kazakhstan Stock Exchange, and Astana International Exchange, with its majority shareholder, Samruk Kaznya (Kazakhstan's National Wealth Fund), holding 41%.

Air Astana Group President and CEO Peter Foster took over the controls in 2005. He joined the airline from Royal Brunei Airlines, where he served as CEO for three years, after 17 years in senior roles at Cathay Pacific. In October, he hosted a small group of aviation journalists at Air Astana, where *Air International* had the opportunity to talk with him.

Looking back to 2005, *Air International* asked Foster what the central message at the heart of his time at Air Astana was and where his focus was. He replied that he and his team knew they wanted a high-quality, full-service airline, which he set out to achieve.

"The first thing I did was to get a team of trainers from Singapore Airlines in because we knew from the very start that we wanted to be high-quality, and that will never change," he explains. "So, it's quite clear that the focus is being a quality full-service carrier, and people love us for that, both in the local market and increasingly in the foreign market."

Optimising the fleet is key

At the end of June this year, the Air Astana Group had a fleet of 54 aircraft, which will reach 59 by the end of the year. Apart from three Boeing 767s, the fleet is an all-Airbus affair comprising A320ceos, A320neos, A321ceos, A321neos, and A321LRs. The airline has retired its fleet of Embraer E190-E2 jets, which will all be redelivered by 2025.

Air Astana has orders with Boeing for 787 Dreamliners. When asked about their delivery, Foster seemed somewhat nonplussed, describing the situation at Boeing as "almost like a slowly unfolding Greek tragedy – it just gets worse and worse".

Boeing's latest projection is that the 787s will arrive in late 2025, although there is little certainty or confidence that this will happen. Regardless of the 787 arrivals, Air Astana is keeping its Boeing 767-300ERs until at least the end of 2028, as they are well-suited to meet the demand on some seasonal routes.

"We specifically use the 767s on what

I call high-season markets, which are in the summer on European routes and the winter on Southeast Asia services where they do a good job for us," he adds. "If you've got a high-season aircraft, then you don't need vast numbers of them."

A working in-house capability

Despite its location and relatively small size, Air Astana is a highly self-sufficient airline that has invested heavily in its maintenance, repair, and overhaul (MRO) capabilities and a Flight Training Centre for pilots and flight attendants. The MRO expertise is paying off handsomely for the airline, particularly on a new project to extend the range of the Airbus A321neo LRs.

In September, Air Astana announced it had completed the installation of the first additional Central Fuel Tank (ACT) on an A321LR, making it possible to operate nonstop flights between Almaty and London Heathrow, a route previously flown with a technical stop in Western Kazakhstan for refuelling.

The modified aircraft entered service soon after and is now regularly flying between Kazakhstan and London, cutting the block time from 11.5 hours to around nine hours. It is planned to have four A321LRs fitted with ATCs by the end of the year and the fleet completed by the start of 2026.

"We ordered seven extra LRs from a lessor that will be delivered from 2026 and will be modified as they arrive. There's no point having non-modified aircraft in the fleet as it's just too complicated to plan them, even though not all routes require that capability."

Air Astana has almost turned their A321LRs into A321XLRs, with the range narrowed to approximately 200-300 nautical miles between them. The ATC fits neatly into the belly of the A321LR. With that aircraft generally operating longer flights, there is negligible demand for cargo, so fitting the tank there causes no issues.

"If you look at it, we are doing routes that go to the absolute edge, and when we got our first A320s in 2006, you couldn't conceive of flying an A320 between Kazakhstan and London or Phuket or Japan. We were trundling around with 757s until 2020, and now we're getting 40 to 50% fuel savings with the same configuration of aircraft we were operating four years ago."

Air Astana has invested heavily in developing its in-house MRO

➔

air astana
FlyArystan
air astana
02

CLOCKWISE FROM LEFT:

CEO Peter Foster says: "We knew from the very start we wanted to be high quality, and that will never change"

New routes are due to open utilising the Airbus A320 family narrowbody fleet

The Air Astana Group has adopted a two-airline model to meet differing market needs better

Astana Flight Training Centre

Many airlines outsource elements of their operations to third-party providers, but Air Astana believes in building its own in-house training and operational facilities that allow it to develop and nurture a pipeline of talented professionals.

In September 2023, the airline officially commissioned its Air Astana Flight Training Centre at Astana International Airport. The purpose-built facility houses both pilot and cabin crew training, using state-of-the-art equipment and techniques that were previously unavailable in Central Asia.

It is the first in Central Asia to be certified by the European Union Aviation Safety Agency (EASA). It contains the first full-flight simulator, an L3 Harris Reality Seven, ever installed in Kazakhstan. This will enhance the country's pilot training capabilities and eliminate the need to send Air Astana pilots overseas for simulator training, eventually supporting the aviation industry within the region.

The centre will operate 24/7 and train more than 500 pilots from the Air Astana Group. It builds on the pilot ab initio program launched in 2008, and the Almaty Training Academy opened in 2018.

Air Astana also added a Cabin Emergency Evacuation Trainer and a Real Firefighting Trainer to simulate more realistic aircraft evacuation and firefighting situations for in-house training of flight attendants and pilots.

Air Astana Group President Peter Foster is confident that the new facility will ensure the highest performance standards and "not only prove to be a highly cost-effective resource for Air Astana, but also result in Kazakhstan becoming a regional leader in flight training."

He told Air International that plans are already in place to expand the facility and add a second simulator, which is needed as the Group aims to hire an additional 100 pilots and a similar number of flight attendants per year for the next five years.

LEFT:
The airline can now train its A320 series of pilots in-house at the new Flight Training Centre

BELOW:
The Boeing 767 widebodies operate on specific high-season European and Asian routes

RIGHT:
Air Astana has a full range of MRO capabilities for its A320 aircraft family

BELOW RIGHT:
In November 2024, Air Astana completed its first 12-year C-Check

capabilities in Astana and Almaty. In November, it became the first Kazakh carrier to complete a 12-year heavy maintenance C-Check on one Airbus A321 aircraft.

This check involves stripping the A321 back to its bare bones with the engines removed so a full inspection of the aircraft structure and components can be done. The cabin floors, walls, ceilings, seats, and structures are removed, exposing the wiring and other systems for inspection.

Air International was invited into the inner sanctum to see first-hand how extensive the 12-Year C-Check is. They watched as the Air Astana team worked their way through the jet from nose to tail. The aircraft was in pieces in October, but since then, it has been reassembled and passed all of the technical, safety, and performance tests before returning to service.

The 12-year C-Check is the most complex level of the A321 maintenance program. Air Astana has methodically built its MRO capabilities, including investing in equipment, tooling, and upskilling technicians to match its fleet profile. It has continued developing its people and facilities far beyond the point at which many airlines stop and outsource these heavier checks to third-party providers.

Growth is always a focus

Foster's public company status limits his comments, but he suggests new routes, such as Astana to Bangkok or Almaty to Tokyo. Growth markets include the Middle East, where new services to Dubai and Abu Dhabi will be launched, as well as flights from Shymkent and Almaty to Jeddah and Medina in Saudi Arabia.

In August, Air Astana signed a codeshare agreement with Japan Airlines that will enhance connectivity for business and leisure between Kazakhstan and Japan and foster the movement of people and goods between the two nations. The

> *"Many airlines outsource elements of their operations to third-party providers, but Air Astana believes in building its own in-house training and operational facilities"*

codeshare will allow both airlines to place their respective codes on a new Almaty to Tokyo service scheduled to be launched by Air Astana in March 2026.

The agreement includes Air Astana routes between Almaty and Tokyo and Almaty-Astana/Atyrau and Japan Airlines Tokyo-Sapporo/Nagoya/Osaka/Fukuoka and Okinawa services. It also covers both airlines' domestic flights, opening up significant new options for travellers from Kazakhstan, Japan, the Far East, and Central Asia.

Regional and global airline attention is increasingly focused on India, where Air Astana operates flights between Almaty and Delhi. The CEO is keen to see that number grow when the time is right.

"The Indian market is of huge interest to us, and we have a lot of potential. A lot of management and commercial attention is focused on India right now. With its huge outbound travel growth, India is a market where we carry a lot of local traffic, and we are extremely conscious of the huge potential of the Indian market."

Foster wants to see the balance between local and foreign traffic shift more towards the latter. He believes that the current mix of 75% Kazakh traffic and 25% foreign traffic is out of kilter, particularly with a home market of just 20 million people.

He says the significant potential is for outbound growth from third-country markets. Foster cites South Korea and the Gulf as regions where the airline will do better as Central Asia becomes more of a destination for business and leisure travellers, spurred on by the expected growth from Japan.

"Air Astana has done well, and we are a good, profitable airline, but I think we are too much of a local carrier, and we need too much more of a regional and global carrier," he tells *Air International.* "We are much more focused now as a management team on getting more local traffic from all of these markets, and that's the focus as we go forward."

Kazakhstan was formerly part of the Soviet Union and retains many links to Russia, although flying into the country is not one of them. While air travel is possible between Kazakhstan and Russia, Air Astana ceased its services when the Ukrainian conflict started in March 2022. The ongoing impact is that flying times to Europe have significantly increased as the airline does not overfly Russia, which Foster describes as "an irritant that's not going to change anytime soon".

He explains: "We lost that market, but Russia was slow to come back after COVID-19, and by the time February 2022 came around, it was so small it didn't really bother us. A lot of business has gravitated from Russia to Kazakhstan as many businesses and Russian people left and came down here."

The two-airline strategy

In 2019, the Air Astana Group launched Kazakhstan's first low-cost carrier, FlyArystan. This move was both a reaction to the growing demand for more low-cost flights and a business opportunity for Air Astana to expand its domestic market. ➔

First 12 year check NQZ Base by Air Astana

LEFT:
Air Astana has installed an A320 full flight simulator fully certified by EASA
Michael Doran

BELOW LEFT:
The new Astana Flight Training Centre is where cabin crew and pilots undergo emergency procedures training
Michael Doran

BELOW RIGHT:
The FlyArystan fleet of Airbus A320s shares the EASA-certified MRO facilities with Air Astana
Michael Doran

While history has not been kind to full-service carriers starting low-cost airlines, this has been a runaway success in the short time it has been operating. In 2024, FlyArystan was awarded its own Air Operator Certificate (AOC) from the Aviation Administration of Kazakhstan (AAK) and, from the start of 2025, will market flights under its FS IATA code.

While now a separate airline, it is a wholly-owned subsidiary of Air Astana. The two airlines share resources such as pilots, engineers, MRO facilities, and other services. Foster said there are only two successful examples of the model, naming Qantas/Jetstar and Singapore Airlines/Scoot as the groups that have worked.

"The companies get on and do their own thing, but there has to be an arbiter or wicked wizard on the mountain who decides who gets what route, and I do have that role. We do have ultimate control of who gets what capacity, so we try to manage that process as best as possible.

"FlyArystan is doing very well, and it's a strongly growing business with a very different passenger profile and very little overlap," he says. "FlyArystan actually provides a perfectly good service, but if we brand substitute Air Astana with a FlyArystan aircraft, it really does not go down all that well; it's a very different market profile with many first-time travellers."

The region is attracting more competition

Airlines are always looking for new and profitable routes, so it's no surprise that the success of Air Astana and FlyArystan is attracting more carriers to the region. Competition is not new to Air Astana, as it has been competing with carriers such as Turkish Airlines to Istanbul and Lufthansa to Frankfurt for years.

More competition is emerging from the Gulf, where Air Astana has seen its market share erode. However, the Gulf is also one of the airline's biggest growth markets. "There's a lot of capacity competition from the Gulf, Flydubai, Air Arabia, Flynas, Jazeera, Etihad, and others."

"The local competition is Scat, who took over the Russian flying from Air Astana operates Boeing 737 MAXs now and are a different airline to what they used to be. They are not the same type of airline as us but are a substantial domestic operator with about 34% of the domestic market." **AI**

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Creating the catalyst for carbon-neutral flights

OXCCU
OX1
Demonstrator Plant

In August 2024, the company announced the launch of its first official demonstration plant, OX1, at Oxford Airport

Achieving carbon-neutral aviation by 2050 is a challenging target. Oxford Airport-based OXCCU believes it can be achieved and has taken the first step to making huge emissions reductions, as **Bernie Baldwin** reports

Although aviation is one of the leading industries in its desire to become sustainable, some believe it will struggle to meet its targets, particularly IATA's goal of net-zero carbon emissions by 2050.

There are programmes for all-electric, emission-free aircraft, but they are not likely to replace the workhorses of the industry – the Airbus A320 Family and the Boeing 737s – never mind the long-haul fleets. Hydrogen-powered aircraft are thought of as being the most likely successors in that area.

However, in the meantime the swiftest route to achieving significant reductions in emissions from larger aircraft is sustainable aviation fuel (SAF). Although SAF is discussed as a singular term, there are, in fact, different types of SAF produced by a range of methods.

In its fact sheet of SAF, IATA outlined its definition of the fuels as follows:

"SAFs are liquid fuels currently used in commercial aviation, which can reduce CO_2 emissions by up to 80%. It can be produced from a number of sources (feedstock) including waste fats, oils and greases, municipal solid waste, agricultural and forestry residues, wet wastes, as well as non-food crops cultivated on marginal land. They can also be produced synthetically via a process that captures carbon directly from the air.

"SAFs can be considered 'sustainable', as their feedstocks do not compete with food crops or output, nor require incremental resource usage such as water or land clearing, and more broadly, do not promote environmental challenges such as deforestation, soil productivity loss or biodiversity loss. Whereas fossil fuels add to the overall level of CO2 by emitting carbon that had been previously locked away, SAF recycles the CO_2, which has

> *“There are three non-negotiables – aviation fuel (because you can’t get over the Atlantic without a hydrocarbon) as well as chemicals and plastics, because they are carbon-based. We’ve got to stop doing what we’re doing currently because the world is getting too hot”*
> Andrew Symes, CEO, OXCCU

been absorbed by the biomass used in the feedstock during the course of its life.”

OXCCU, a climate technology company spun out of the University of Oxford, is among those developing processes to produce SAF synthetically. In particular, the company is developing novel catalysts and reactor designs to convert carbon dioxide and hydrogen into hydrocarbons with high conversion and selectivity for use as fuels, chemicals and plastics.

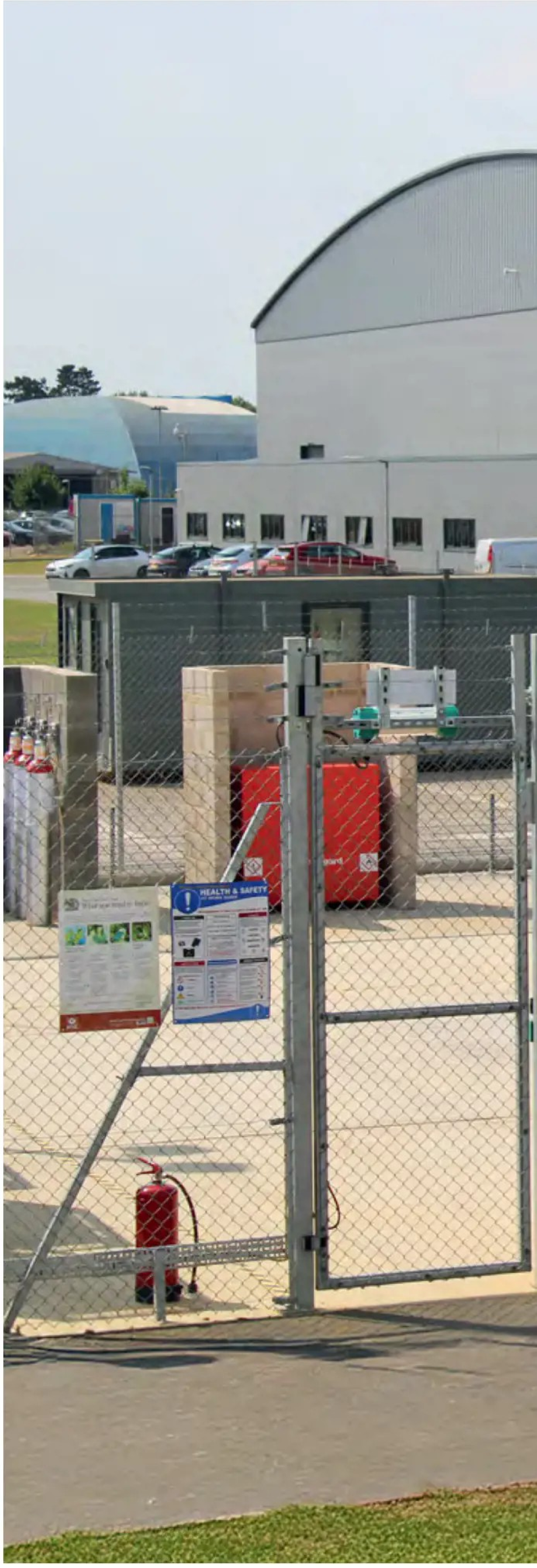
To describe the process of “making jet fuel from CO_2” and its advantages over others, Andrew Symes, CEO of OXCCU, began with a simple maxim. “Let’s start with this fact, which I think is often missed: we will still have to have hydrocarbons even in a net-zero world.

“There are three non-negotiables – aviation fuel (because you can’t get over the Atlantic without a hydrocarbon) as well as chemicals and plastics, because they are carbon-based. We’ve got to stop doing what we’re doing currently because the world is getting too hot. That, and increasing rain, are going to make it more and more expensive for humans to live comfortably. So where are you going to get those hydrocarbons from?”

Symes pointed out that the first attempts at solving this challenge came in the early 2000s with biofuel. In the US, this was derived from corn, while in Europe, it was made from vegetable oil. He said: “Actually, a lot of the vegetable oil we have for fuels in Europe comes from China. More recent efforts have been trying to use waste-based carbon – municipal solid waste, wood waste, straws, different supplies. But the problem is that they haven’t delivered. Why is that? Well, the problems with the first generation are well known – land use. A good field can be used to grow food. It’s not any more complicated than that. And it can’t be scaled to meet all chemicals, all plastics, all aviation fuel.”

Symes believes biofuels can play a role but aren’t enough alone: “The answer is carbon dioxide, which is the cause of global warming, but it also can be a huge part of the solution. Carbon dioxide can be reacted with hydrogen, green hydrogen – from water and electricity – to form fuel and water. Yes, a lot of electricity is needed to make the hydrogen, but this reaction actually wants to form fuel and water.

“This is the so-called circular economy for carbon. So, CO_2 is made into aviation fuel; it gets burned, goes back to CO_2, CO_2 is captured, is combined with green hydrogen, and goes back to make more



OPPOSITE TOP:
Andrew Symes, founder and CEO of OXCCU, firmly believes commercial aviation can be cleaner in the future
All images via OXCCU

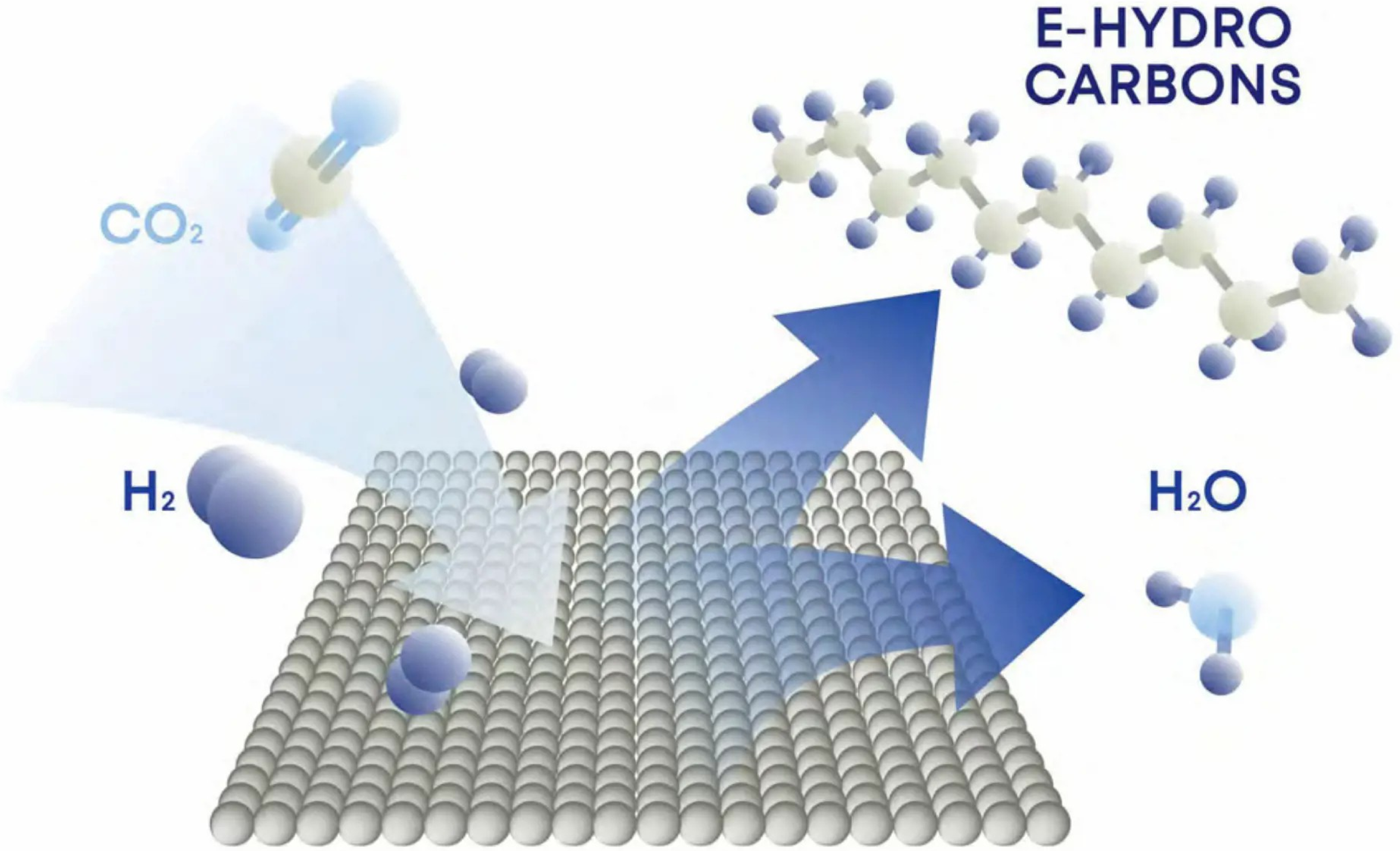
BELOW:
The OX1 plant represents a significant advancement in SAF production. The plant will convert CO2 and hydrogen directly into long-chain hydrocarbons with high conversion and selectively for use as SAF

fuel. You go around in a circle," Symes explained, while admitting that as CO_2 is quite diluted in the atmosphere, it will take quite a lot of energy to capture it properly. "We can move towards that, but in the short term, we can use industrial sources of CO_2, which will get you emission reductions approaching 90% compared with fossil fuels. It's not perfection, and we're not saying it is, but we can move towards that.

"There's no reason that can't happen because the beauty of this is that the input CO_2 and hydrogen are theoretically unlimited. Yes, it starts small, but it can grow and scale and become very big," he said. "That's what is exciting about e-fuels and power-to-liquid fuels – that we are selling into a market that we already know is huge. The main challenge for e-fuels is cost, not feedstock. It's too expensive. With biofuels, the challenge is feedstock. With us, it's cost."

The CEO defined the answer as OXCCU sees it: "Essentially, it's catalysts. These enable the conversion of CO_2 into fuel. If you mix CO2 and hydrogen, they won't do anything. The catalyst enables the reaction. It also stops some reactions and enables other reactions to happen quickly. And our catalyst enables you to get CO_2-derived fuel at a lower cost," he said. ➔

OXCCU
OXCCU



ABOVE:
OXCCU is a leading carbon-to-value company converting carbon dioxide into fuels, chemicals and plastics

The Fischer-Tropsch process is the critical reaction for creating long-chain hydrocarbon fuels. According to Symes, most organisations that convert CO2 and hydrogen to fuel first convert carbon dioxide to carbon monoxide, which reacts with green hydrogen to make fuel.

"This works, but the first step requires a huge energy input, and there are a lot of separation steps. It's not easy to integrate these, which leads to high capital costs and high operating costs," he noted before coming to the crux of the OXCCU process's advantage: "What we have at the bottom is a catalyst that will directly convert hydrogen and CO_2 straight through to jet fuel range hydrocarbon, so you don't have to go via CO.

"CO does become present, but immediately it is formed on the surface it carries on reacting. So, you don't ever see the CO in the process. The whole reaction is now simplified, with two steps combined into one. That creates a significant reduction in capital and operating costs and ultimately lowers the cost of CO_2-derived fuel. This is why OXCCU's catalysts will enable us to fly without a climate impact. We know we're not the only part of this puzzle, but we do think that we're a key part," Symes said.

"Also, we need electricity to continue to be more and more green. In other words, we need more and more renewables."

Having developed its process, OXCCU has progressed to opening its OX1 official demonstration plant at London Oxford Airport, which it says represents "a significant advancement in SAF production". The facility is now producing 1kg (approximately 1.2lit) of liquid fuel per day, which has been branded OX•EFUEL.

The plant is one of the earliest stages of scaling up and is the first OXCCU plant outside the laboratory. In 2026, it will provide the data key to designing, building and operating a 160kg (200lit) per day OX_2 plant at Saltend Chemical Park in Hull.

Symes is thrilled to have reached this stage. He said: "We've got a world-leading lab and some of the best equipment in the UK, essentially to test catalysts and to recreate what was done on one reactor for a small amount of catalysts. But we can now do it on much bigger scales. We can start thinking about making much larger quantities of catalysts, putting them into more and more shaped forms. On the back of that, we basically went out and raised our Series A funding before demonstrating this on a larger scale.

"We have world-leading investors. We've got United Airlines, Aramco, ENI, Trafigura, Doral, TechEnergy Ventures, Braavos and, obviously, the University of Oxford. We also have two leading venture capital funds, Kiko, which is part of IP Group, and Clean Energy Ventures, which is based out of Boston. And they're all excited by this idea, essentially reducing the cost of power-to-liquid fuels," the CEO said.

Going to produce 160kg/200lit of fuel daily at Saltend will lead to OXCCU having hundreds of litres of fuel for jet fuel testing to give to customers. “We will obviously be getting revenue from that, but ultimately be looking at licensing this technology globally towards the end of this decade,” said Symes. “We’re looking at sites in the UK. They are often in the industrial clusters, places where there is existing chemical infrastructure and good access to renewables.

“We’re also looking at sites in the Middle East, the East Coast, Canada, Texas and South America. This is truly global. E-fuels are not for everywhere right now. You need to have good renewable resources and capture CO_2,” he added. “There is an increasing number of places where that does exist, and they are the prime spots for the first power-to-liquid fuel plants. Once the fuel is made, it can be transported, blended, refined to whatever you want, using all of the existing infrastructure available today.”

Symes emphasised that OXCCU’s eventual business model is focused on licensing: “We want to make catalysts and license the reactor and process designs. But we are distinct from the project developer, who is essentially building and financing the project.”

When it comes to the amount of catalysts required to produce 1kg of fuel and how swiftly a catalyst might get depleted, Symes explained: “Within a chemical reaction, the catalyst ideally isn’t changing at all, and it stays in the same form basically throughout as the reaction proceeds. Actually, though, the catalyst does change a bit on the surface. The catalyst tube is filled and lasts until the performance reaches a point where you want to change it out.”

Symes returned to the question of CO_2 feedstock, and where it is currently sourced: “There are three sources. One is from the atmosphere, and you capture it directly. That’s far off at the moment and probably unnecessary, given that we emit 38 billion tons of CO2 every single year. It’s going to happen eventually, but let’s park that for now.

“The short term involves two options. One is biogenic CO_2, a by-product of a biomass process. For example, making biogas produces CO_2, just as making ethanol does,” he continued. “The other area, which offers the largest amount of CO_2, is from industrial sources, where fossil fuels have been burnt, made CO_2, and that CO_2 is then getting reused. The carbon gets used twice before it goes into the atmosphere. That, however, is not circular; that’s a lower carbon fuel but not carbon neutral.”

Symes agreed that the messaging associated with the technology must be carefully presented: “Right now, it must not be thought that there are just going to fans all over sucking in air to capture carbon, which will then come out as a hydrocarbon and subsequently a fuel with a perfectly circular cycle.

“As noted, OXCCU is calling it a lower carbon fuel. That has value because it’s about reducing emissions now. If you wait for perfection, people will still keep flying, and the world will get hotter and hotter. If you demand perfection immediately, then honestly, nothing will get done,” the CEO said.

Symes and his team believe the situation is too important to let that happen. **AI**

BELOW:
OXCCU has reduced a traditionally multi-step process to a single step, avoiding the need first to convert CO_2 to carbon monoxide – a difficult-to-electrify and energy-intensive first step

Is there a European ‘Sixth Generation’ future outside FCAS/SCAF and GCAP?

Many have questioned whether Europe can really support two next-generation manned air dominance programmes in the shape of the Franco-German-Spanish FCAS/SCAF/NGWS and Anglo-Italian-Japanese GCAP. An interesting question but one that ignores the fact that further projects are also underway in Sweden and Turkey, as **Jon Lake** outlines

CLOCKWISE FROM LEFT:

The then British Foreign Secretary James Cleverly visited the Turkish Aerospace Industries headquarters in Ankara, Turkey, on September 14, 2023, where he was photographed with the full-scale TF-X mock-up – an aircraft produced with extensive engineering assistance from BAE Systems
Simon Dawson/No.10 Downing Street

Saab hopes to remain at the forefront of combat air platform design and manufacturing through its Konceptet Framtidens Stridsflyg programme. No design has been finalised, meaning that all concept artwork released to date is speculative
Saab

Senior members of the MMU team with the Kaan GTU-01 after the repaint that followed the aircraft's first flight on February 20, 2024. Fourth from the left is Professor Dr Temel Kotil, Chairman and CEO of Turkish Aerospace Industries from 2016-2024
TUSAS

With Britain, Italy, France, Germany, and Spain all locked into their collaborative fighter programmes and with workshare on those projects jealously guarded, Europe's other major military aerospace manufacturing nations faced some difficult decisions. They had to determine whether they should pursue their own programmes at massive cost (and huge risk), try to join an existing programme as a second-tier participant, or accept a withdrawal from high-end combat air design, development, and manufacturing.

Some nations that once had some sovereign aerospace design and manufacturing capabilities scaled back their ambitions, accepting that they would, in the future, enjoy a more limited role in the licence assembly of helicopters, trainers, or transport aircraft and the manufacture of some aerostructures. Poland, for example, took this approach.

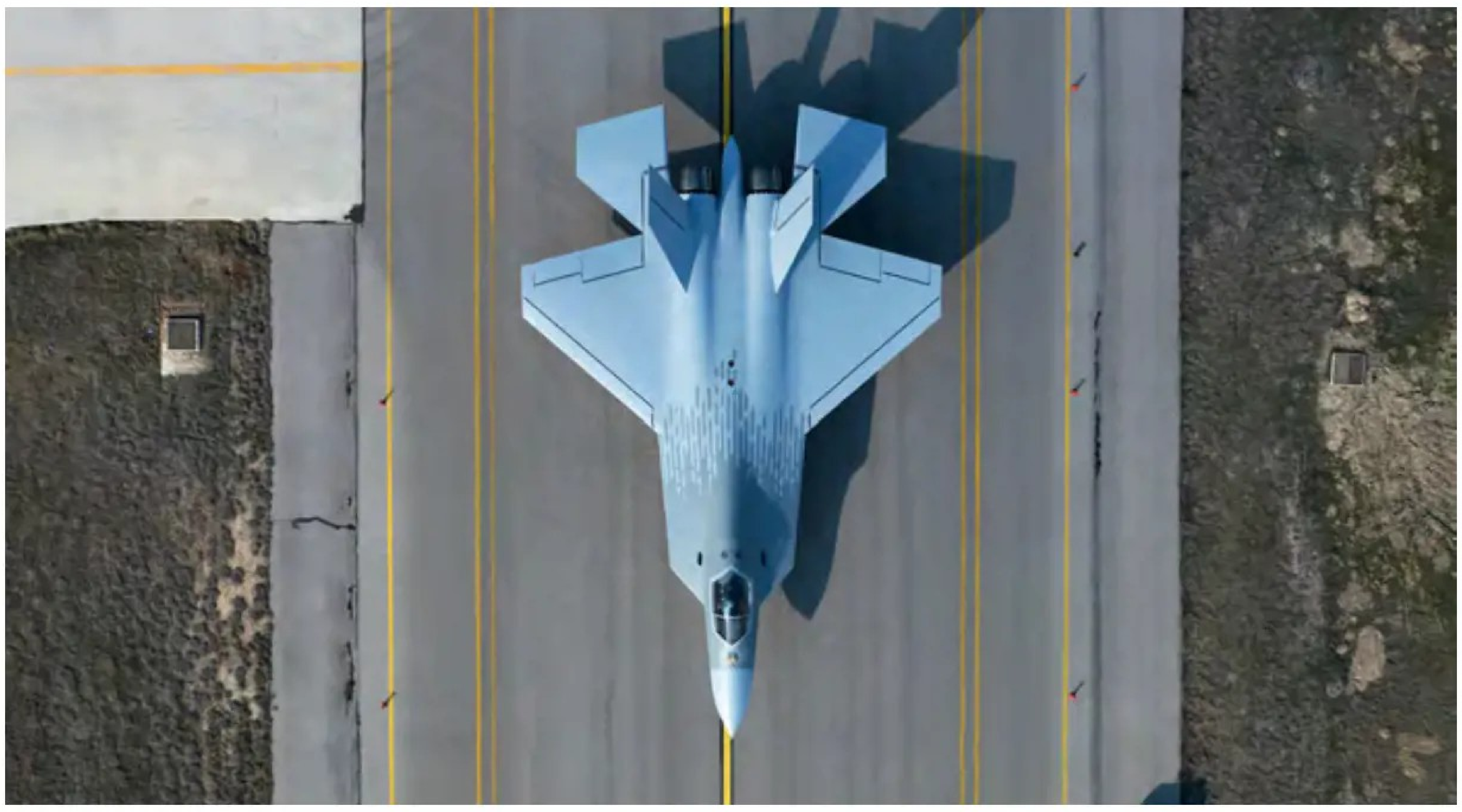
Exceptions were Sweden, which aspired to maintain its hard-won sovereign combat air industrial and design capabilities, and Turkey, which hoped to build and strengthen almost the same competencies.

While Sweden is an established aerospace manufacturing nation with a long and proud tradition of building innovative fighter aircraft optimised to meet local requirements, Turkey is a relatively new member of the indigenous combat air manufacturing 'club', having pursued a progressive and evolutionary build-up of its aerospace industry to the point that it is now developing its first manned fighter aircraft.

Turkish Aerospace Industries (TAI) (locally known as Türk Havacılık Ve Uzay Sanayi Anonim Şirketi - TUSAŞ) took a massive step forward in 1984 when preparations began for the licence manufacture of the F-16 – the first Turkish Fighting Falcon, emerging in 1987. TAI eventually produced 240 F-16 aircraft for Turkey and assembled 46 F-16s for the Egyptian Air Force, gaining invaluable expertise and experience with the F-16 programme and with the licence manufacture of SIAI-Marchetti SF.260 trainers, CASA/IPTN CN-235 light transport/maritime patrol aircraft, and Aerospatiale AS532 Cougar utility and search and rescue (SAR) helicopters.

TAI has undertaken many upgrades, modernisation and structural modification programmes on various aircraft and helicopter types, including converting Boeing 737s into E-7A AEW platforms. In addition, it has also produced a

KAAN
4



LEFT:
The first MMU prototype was ceremonially rolled out on March 18, 2023, after conducting its first taxi trial on March 17, at speeds of up to 15kts. A head-on view shows distinct similarities with the basic configuration used by the Lockheed Martin F-22 Raptor
TUSAS

RIGHT:
Kaan GTU-01, the first of three 'Block 0' prototypes, is a pure technology demonstrator, lacking operational systems, and is unrepresentative of the planned production configuration
TUSAS

BELOW:
Kaan GTU-01 taking off on its second flight. The aircraft's first flight was once planned for 2026, but the programme has been accelerated significantly. Two General Electric F110 engines power the aircraft, but an indigenous powerplant is under development
TUSAS

large number of aerostructures, including fuselage panels for Airbus 319/320/321 aircraft, wing tips and flight deck panels for the Boeing 737, nose gear doors for the Boeing 747, dorsal fins for the 777 and parts and subassemblies for the 737/767/777. TAI also manufactures components for the Eurocopter AS 532 helicopter, MD 902 fuselages for MD Helicopters, AB139 fuselages for Agusta, rear doors and engine cowlings for Eurocopter EC135 helicopters, horizontal stabilisers, tail rotor pylons and tail booms for Sikorsky S-70A and MH-60 helicopters, and horizontal stabilisers for Sikorsky S-76 helicopters. Perhaps most significantly for Kaan, TAI was given a contract to produce the centre fuselage of the F-35 Joint Strike Fighter aircraft.

This put the company in a great position for indigenous aircraft programmes, including the Anka UCAV and Hürjet advanced jet trainer. These programmes, in turn, have helped prepare the company for its most ambitious programme to date, the Kaan ('Ruler' or 'King of Kings').

Perhaps this is the best time to address the lazily applied and ill-defined 'generation' terminology surrounding any discussion of next-generation air dominance platforms and programmes. Lockheed adopted the 'fifth generation' tag as a marketing tool for the F-22 – extrapolating forward from a Soviet system of designating fighter generations. The fifth generation definition included stealth, supermanoeuvrability, supercruise, and advanced integrated avionics. However, that definition was amended to omit supercruise once it became clear that the company's second '5th Gen' fighter, the F-35, could not reach and sustain supersonic speed without recourse to afterburner! As a result, the 'fifth generation' tag came to be applied based on stealth and advanced avionics and sensor capabilities.

If the 'fifth generation' designation is somewhat opaque, then the 'sixth generation' label has not been officially defined and is even more challenging to pin down. It may be boiled down to an aircraft that is "more advanced" than current fifth-generation fighters, probably with significantly greater range/endurance, internal payload and using advanced data-driven stand-off PGMs and BVR air-to-air missiles. Advanced variable-cycle engines may be essential, allowing the aircraft to cruise economically while delivering massive electrical power and cooling, and producing very high thrust when required.

A range of features have been claimed to characterise the so-called 'Sixth Generation', though some may not actually appear when the first members of this new generation materialises – which remains some way into the future.

The sixth generation fighter is usually assumed to be the core element within a wider 'system of systems', supporting and supported by a range of unmanned adjuncts and effectors. This, in turn, suggests that manned-unmanned teaming (MUM-T, or crewed-uncrewed teaming) will be a key feature. At one stage, it was assumed that the aircraft might be optionally manned, with the same airframe capable of conducting piloted, remote controlled or onboard-AI-controlled missions. As the trend away from the most expensive and exquisite unmanned adjuncts has continued, this now seems more fanciful, as the high cost of a future sixth-generation fighter would make it no more attritable or expendable in unmanned form than it would be with a pilot on board.

It can be assumed that a sixth-generation fighter will have an advanced, low-observable (stealthy) airframe and advanced, highly integrated sensors, electronic attack, defensive aids, datalink, and communications systems. These will be part of an open systems architecture that will be optimised for rapid upgrade. Probably, all flight safety-critical functions will be partitioned to ease upgrade testing and certification. The sixth-generation fighter will almost certainly be designed using Digital Engineering (model-based Design).

Some advanced digital capabilities, including data fusion, high-capacity networking, AI, cyber warfare, and battlefield command, control and communications (C3) capabilities, can be assumed. Other capabilities may be being studied, but the light of day may not be seen on a production fighter; these include virtual cockpits and directed-energy weapons.

The sixth-generation label may not really apply to the Kaan, which may be better thought of as a fifth-generation fighter or a fighter incorporating some 'fifth-generation' features – like KAI's KF-21, perhaps?

The Kaan is the product of the TF-X or MMU (Milli Muharip Uçak, Turkish for 'National Combat Aircraft') programme and, so far, the first European 'next-generation' fighter to fly. Whatever its 'generation', the Kaan is an impressive achievement, and it is expected to adapt to meet changing requirements.

Turkey's Defence Industry Executive Committee (SSIK) launched the development of the MMU, a next-generation air superiority fighter, on 15 December 2010. The MMU was intended to be a low-end fighter with a high-low mix, similar to the F-35 Lightning II. The F-35 would replace the F-4E Phantom in the attack role, while the indigenous MMU would replace Turkey's F-16 fleet.

Following a two-year conceptual design phase, a twin-engined configuration, known as FX-1, was selected. On August 5, 2016, the Ministry of Turkish National Defence SSM awarded Turkish Aerospace Industries Inc. a contract to design and develop the TF-X fighter. By then, the UK's BAE Systems had been contracted to assist with the design of the new fighter, providing engineering assistance and other services.

Development phase one, stage one, started in late 2018 and led to the system requirements review in 2022. Phase one and stage two began, allowing detailed design to begin. The design was qualified using three Block '0' development aircraft.

The first of these, known as GTU-0, was ceremonially rolled out on March 18, 2023, and is a technology demonstrator lacking operational systems. It is unrepresentative of the planned production configuration.

The date of March 18 was specially chosen since it is celebrated in Turkey as Victory Day, commemorating the battle of Çanakkale (also known as Gallipoli). The date had a particular resonance in 2023 – since it marked the 100th anniversary of the founding of modern Turkey by Kemal Attaturk.

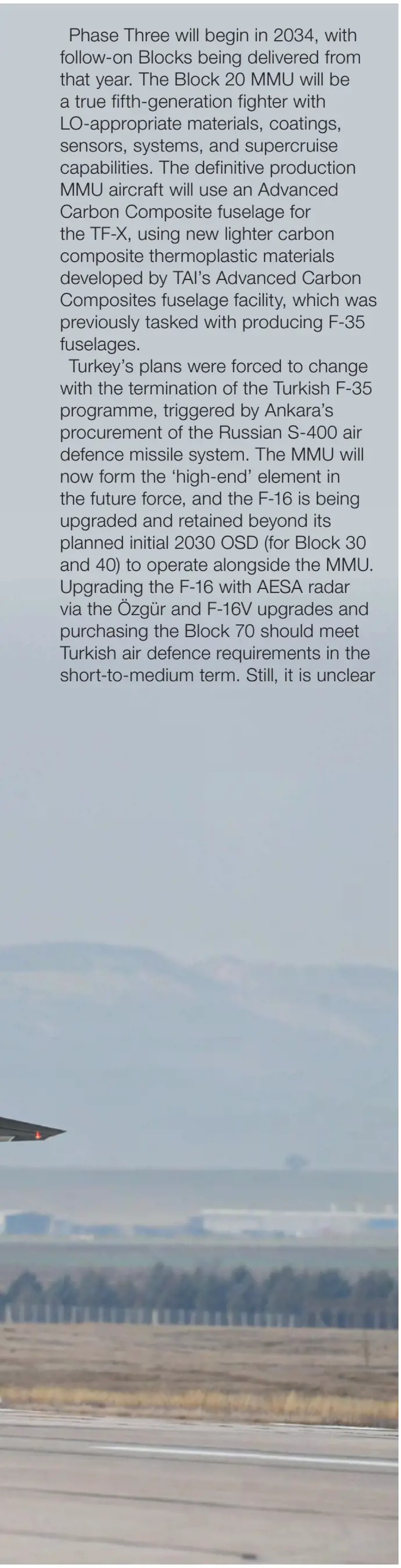
The aircraft undertook its first taxi trial on March 17, at speeds of up to 15kts. The aircraft made a public appearance on May 1, when it was named Kaan by Turkish President Recep Tayyip Erdoğan during a Century of the Future event at the Turkish Aerospace Industries (TAI) Ankara headquarters. This aircraft completed its 11-minute maiden flight on February 20, 2024.

Two General Electric F110 engines will power the three Block '0' development aircraft, although later aircraft are expected to use indigenous engines.

The second Block 0 prototype (known as P1) is due to fly in 2025 and will be more representative of the planned production aircraft. The third aircraft is expected to fly in 2026.

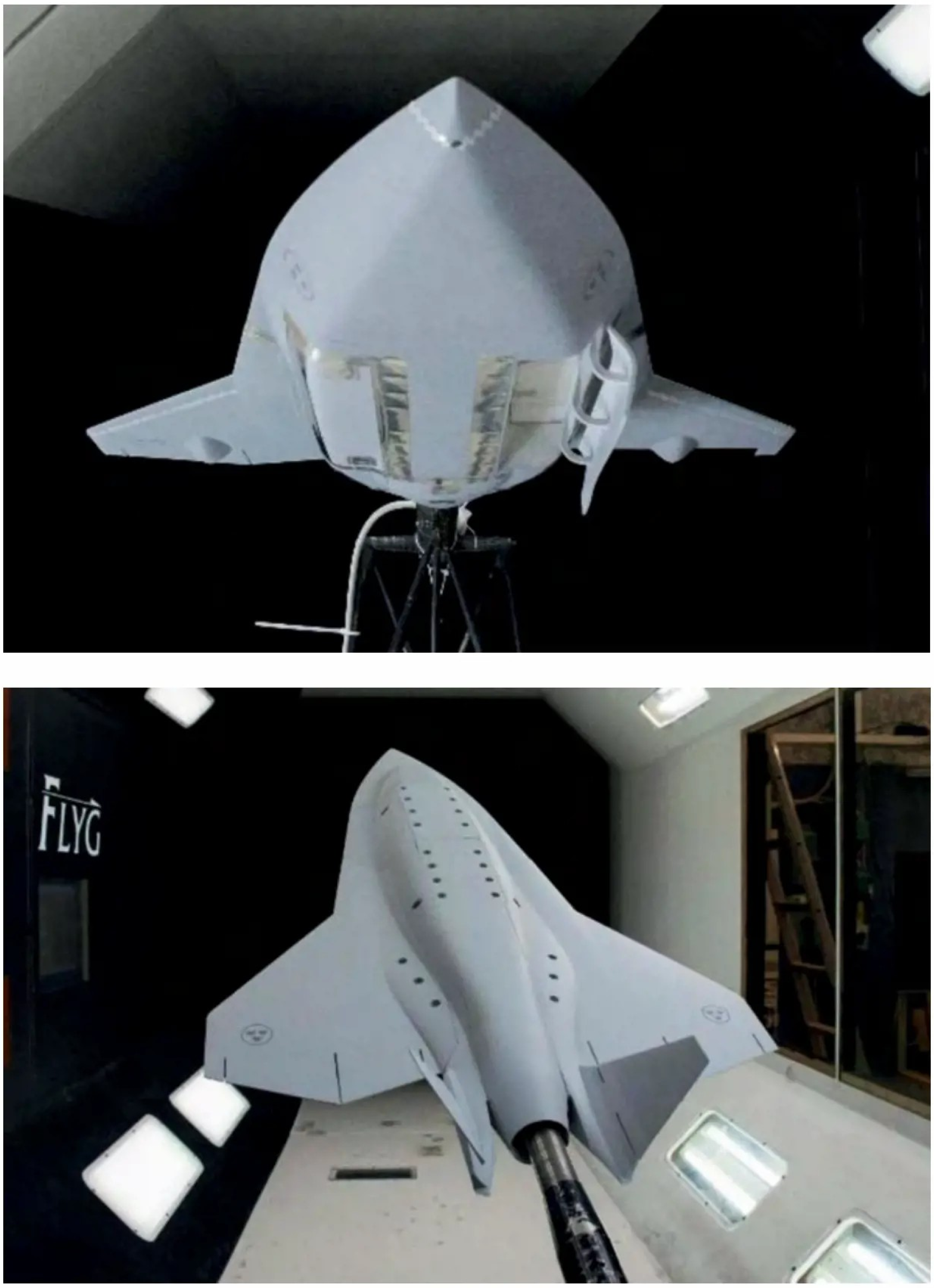
Phase Two will begin in late 2028 and include the delivery of ten pre-production Block One aircraft to the Turkish Air Force between 2030 and 2033. By 2029, the delivery rate will rise to two aircraft per month.

The MMU was named Kaan ('Ruler' or 'King of Kings') by Turkish President Recep Tayyip Erdoğan on May 1, 2024, during a Century of the Future event at the Turkish Aerospace Industries (TAI) Ankara headquarters
TUSAS



Phase Three will begin in 2034, with follow-on Blocks being delivered from that year. The Block 20 MMU will be a true fifth-generation fighter with LO-appropriate materials, coatings, sensors, systems, and supercruise capabilities. The definitive production MMU aircraft will use an Advanced Carbon Composite fuselage for the TF-X, using new lighter carbon composite thermoplastic materials developed by TAI's Advanced Carbon Composites fuselage facility, which was previously tasked with producing F-35 fuselages.

Turkey's plans were forced to change with the termination of the Turkish F-35 programme, triggered by Ankara's procurement of the Russian S-400 air defence missile system. The MMU will now form the 'high-end' element in the future force, and the F-16 is being upgraded and retained beyond its planned initial 2030 OSD (for Block 30 and 40) to operate alongside the MMU. Upgrading the F-16 with AESA radar via the Özgür and F-16V upgrades and purchasing the Block 70 should meet Turkish air defence requirements in the short-to-medium term. Still, it is unclear how well the MMU will meet the high-end platform requirement and whether it will adequately replace the F-35A.

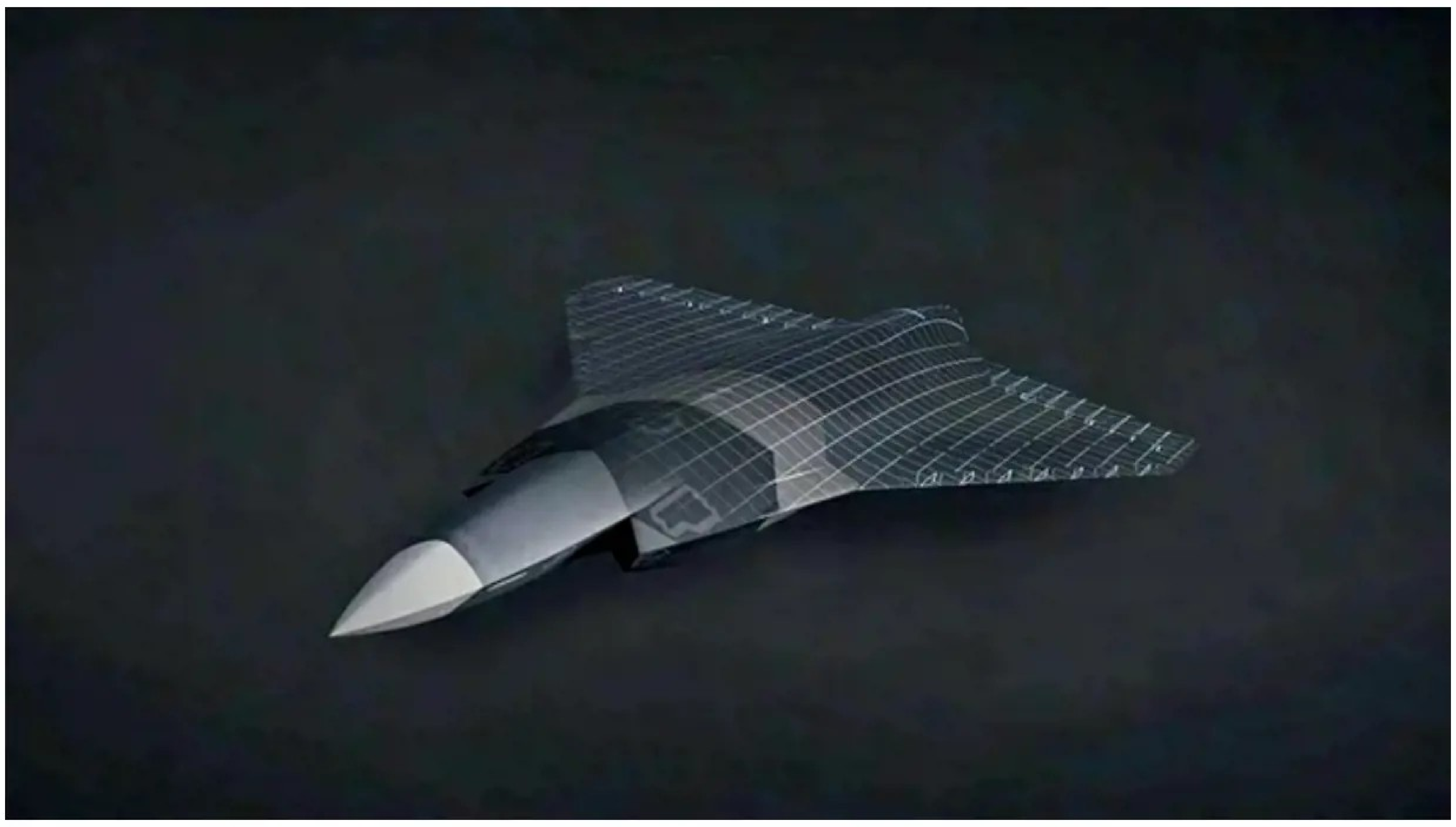


ABOVE:
This Saab loyal wingman concept was tested in the L-2000 wind tunnel at the Royal Technical High School, Stockholm, in December 2021 and subsequently 'broke cover' in September 2022, when it was presented as part of an academic paper at the 33rd Congress of the International Council of the Aeronautical Sciences (ICAS), in Stockholm
Saab

Sixth Gen from Sweden

In July 2019, Sweden and the UK signed a memorandum of understanding (MoU) to collaborate on developing sixth-generation air combat technologies within the FCAS construct. By August 2022, Saab CEO Michael Johansson said Sweden was "now working on the margins of the UK-led Tempest project" as it waited to "better understand how the other partners will establish the programme".

Sweden did not follow suit when the project merged with Japan's F-X program and was cemented into the GCAP in December 2022. It subsequently decided to leave the programme. By November 2023, a Swedish official confirmed that Sweden had left the program and was no longer involved in trilateral studies with the UK and Italy.



ABOVE:

Another unmanned Saab KFS concept. This was first seen accompanying an interview with Peter Nilsson, Saab's Head of Advanced Programs in **Dagens Nyheter*****, on August 24, 2024***

Saab

BELOW:

Saab has been at pains to point out that it is studying dozens of potential configurations for KFS, manned and unmanned, and that this is merely one of those and should not be taken as being indicative of the company's 'direction of travel'

Saab

OPPOSITE:

Some configurations studied by Saab have been modular, with both crewed and uncrewed versions. This one was seen during a presentation by a senior Saab manager

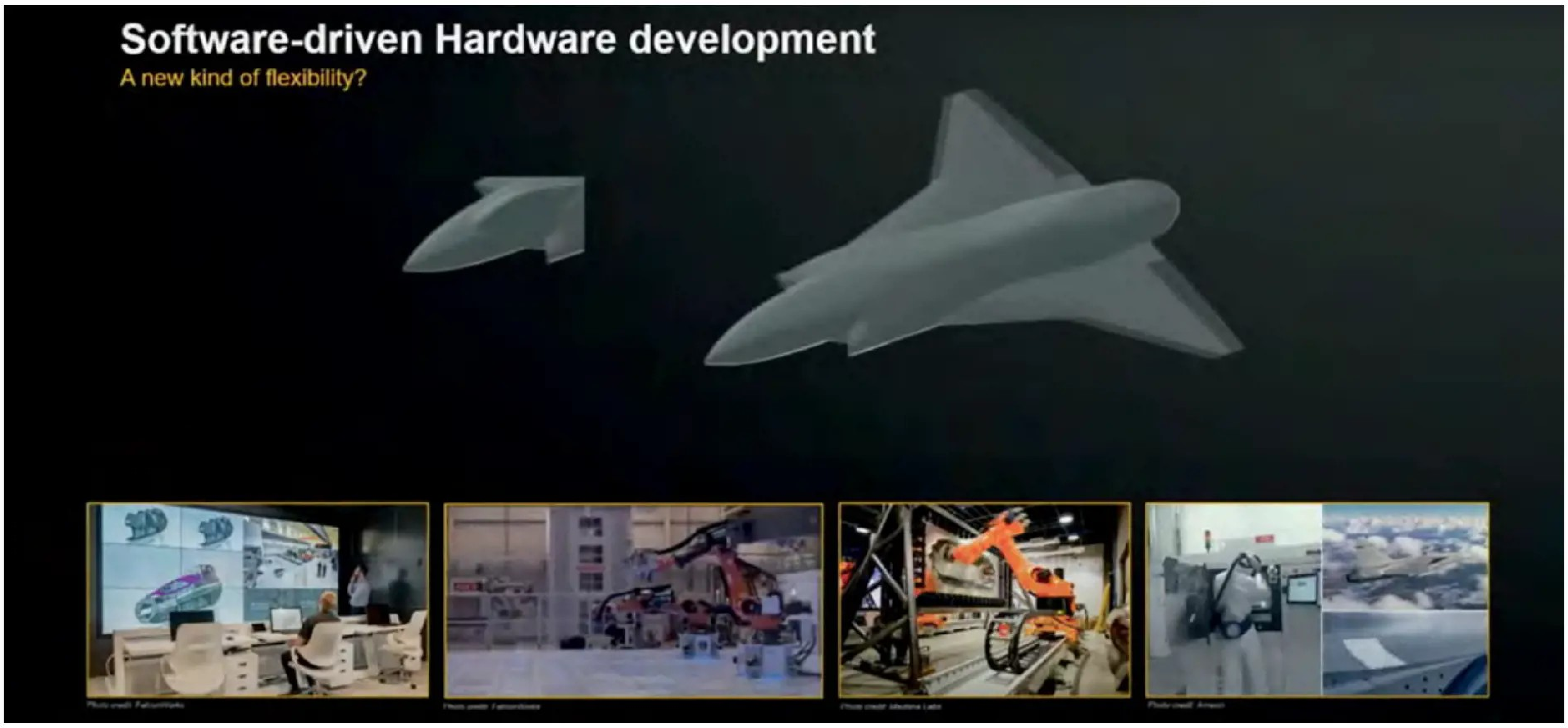
Saab

Peter Nilsson, the head of Saab's Advanced Programmes, later explained that Sweden had undertaken a strategic re-evaluation of its priorities "in light of new developments, both internal and external". Swedish Defense Minister Pål Jonson said that GCAP no longer aligned with Sweden's timeline or strategic requirements.

Sweden then launched a national Future Fighter System (FFS) study to develop its own fighter aircraft. This study began in July 2023 and became the Koncept för Framtida Stridsflyg (or Konceptet Framtidens Stridsflyg or KFS), which translates to Future Combat Aviation.

The FFS/KFS was intended to replace the Gripen when it retires in 2050-2060. Nilsson said that any new aircraft would differ significantly from the Gripen, emphasising low observability, autonomy, and electronic warfare capabilities. Concept CGIs released so far seem to show a single-engined aircraft smaller than today's Gripen, which might explain why Sweden left the Tempest project!

Saab received a formal order from the Försvarets Materielverk (FMV, the Swedish Defence Procurement Organization) for future combat aircraft concept studies on March 22, 2024, with


Software-driven Hardware development

A new kind of flexibility?

the directive that these would include “manned and unmanned solutions in a system of system perspective, technology development and demonstrations”. New and disruptive technologies were expected to form an essential part of the KFS system. Saab’s collaborators included the FMV, the Swedish Armed Forces, the Total Defense Research Institute, and GKN Aerospace.

The contract period was 2024-2025, though it is now being extended. It forms part of a wider Swedish programme expected to run for the next six to seven years or more. Saab has acknowledged that: “We have to be quicker from thought to flight.”

Saab will conduct research into advanced materials, artificial intelligence, and low-observable technologies and submit design drawings for a demonstrator (not an operational prototype) by the end of 2025. The first ‘concept exploration’ phase will transition to a second ‘concept, technology, and demonstration development’ phase, which is scheduled to run from 2026 to 2030. Full development will follow.

The FMV will complete the concept analysis by 2029. During the same period, GKN Aerospace, which produced the RM12 and RM16 engines for the JAS 39 Gripen, will investigate innovative solutions for powering (and cooling) the new fighter. GKN Aerospace’s centre in Trollhättan has received a €59.5m investment to expand its additive fabrication technology capabilities. The company aims to advance industrialisation, reduce environmental impact, and meet future power and propulsion requirements.

On August 24, 2024, in an interview with Swedish daily newspaper *Dagens Nyheter*, Peter Nilsson, Saab’s Head of Advanced Programs, confirmed that Saab was looking at both manned and unmanned fighter concepts as solutions to the Swedish Armed Forces requirement for a sixth-generation combat air platform.

But KFS is a study, not a fighter programme. Sweden has yet to decide whether to develop an indigenous next-generation fighter, join (or rejoin) an existing project, or even buy an aircraft ‘off the shelf’ from a foreign supplier.

KFS’s goal is to provide the evidence needed to support a decision on how to secure Sweden’s combat air capability after 2040 when the Gripen E/F will be retired. Before a decision is made, national defence needs, industrial and employment considerations, and Sweden’s future as a technologically advanced nation will all be considered.

Many believe a wholly Swedish development programme could be prohibitively expensive, jeopardising other critical defence investments. International partnerships might represent a more cost-effective option, and some believe that Sweden is already moving towards some form of international co-operation, probably within a “European or Euro-Japanese framework”.

Lars Tossman, Saab’s head of aeronautics, has pointed out that Saab is uniquely well placed to build a new combat aircraft for Sweden, thanks in part to its mould-breaking exploitation of digital engineering techniques, and the experience gained in the Gripen E, GlobalEye, and T-7A programmes.

Nilsson remains bullish that Saab will continue to build combat aircraft, saying: “Saab and Sweden building fighter aircraft is not going to end with the Gripen. Whether we join someone else or go on our own, there will certainly be something following.”

He believes that concerns about the costs associated with developing a new fighter indigenously are misplaced and has pointed to the development of the JAS 39 Gripen in the 1980s, when similar doubts were raised but were overcome by collaborating with multiple international partners while maintaining control over the overall design process within Sweden. **AI**

The air charter industry provides the UK with significant business opportunities across Europe and beyond
ACA

Keeping charters competitive

According to Glenn Hogben, CEO of ACA, the air charter industry is critical to business growth across the UK, as he explained to **Glenn Sands**

LEFT:
Glenn Hogben, CEO of The Air Charter Association
ACA

Recent changes announced by the UK's Labour government look set to raise the Air Passenger Duty (APD), despite Britain already having one of the highest rates in Europe. Currently, it's one of the fastest-growing of all UK taxes.

APD applies to passengers flying on business jets that have a weight of 5.7 tonnes or more. The rate differs according to a passenger's class of travel and the distance of their flight. A higher rate applies to flights operated by aircraft weighing 20 tonnes or more with fewer than 19 seats.

The prospect of increasing APD further is likely to make the UK increasingly uncompetitive as a place to conduct business, believes Glenn Hogben, CEO of The Air Charter Association (ACA). In post-BREXIT times, the UK's aviation businesses are already dealing with myriad issues daily – for an industry association that prides itself on promoting its services through aviation and still has a significantly high UK membership, announcements by Labour are perhaps an indication that it simply doesn't fully understand what the ACA contributes to the economy.

Founded in 1949, the ACA is the leading trade body for the global air charter industry. It promotes best practices and ensures supply chain relationships by guiding the industry through its own self-regulation procedures, members working hand-in-hand with trusted professionals across the sector. The association's members include aircraft operators, air charter brokers, handling agents, regional airports, manufacturers and a host of associated companies providing maintenance, fuel supply, legal services and flight planning software.

While the core connections between the ACA and the aviation industry have not changed significantly over the years, Hogben points out that charter aviation has adapted throughout the post-pandemic period. The air charter industry responded rapidly to the demand for urgent cargo, evacuation and medical transport both during the pandemic and post-pandemic. It provided reliable freight and business flights to support the UK's economic recovery when it was most needed. But it now appears that both the Conservatives and Labour have forgotten ACA's contribution too quickly.

According to Hogben, the ACA has been actively engaging with the UK government on a wide range of issues affecting aviationr for many years. A core focus of these meetings is promoting the huge value delivered to the UK by the air charter sector, both in terms of supporting economic growth and employment within the UK and the key role the ACA plays in broader innovation within aviation.

Air charter services are not solely focused on wealthy, high-end clients heading off for weekend summer breaks or skiing holidays – that is a very small part of the business. The industry provides a far wider variety of services across the aviation sector, from business/private charter to commercial charter, air cargo movements and medical/humanitarian and repatriation flights. Air charters offer travellers the ability to save precious time and allow increased connectivity to a far more comprehensive range of locations than scheduled airline flights are capable of delivering. Hogben points out that WINGX data shows tha,t in 2024, business jets departing from London airports provided nearly 50% greater unique connections than commercial airlines, with 807 BizAv unique city pairs versus 422 scheduled services.

Business charters provide an essential service to the UK, ensuring the nation remains connected and competitive within the global economy, supporting industry and driving economic growth. In addition, the air charter sector generates direct revenue itself. A report by the DFT's 2021 General Aviation Airfields Study noted in an updated assessment of the economic value of general aviation that business aviation accounted for 85% of the £2bn contribution of overall general aviation—in other words, the largest contribution by far.

Multinational companies, sports teams, orchestras and professional musicians regularly use commercial charters for large groups of people to simplify the logistics of moving large numbers of passengers to a single destination and

➔

A critical role of the air charter fleet is providing critical medical assistance when needed
Smuuthcare/JoinJet

Challenge Handling

ABOVE:
Several specialised jets serve as airborne medical care platforms within the air charter sector
Smuuthcare/JoinJet

RIGHT:
The ability to provide significant logistics by air when required is a core component of the air charter network
Network

meet their specialist equipment needs and challenging schedules. Many of these groups travel by privately charted commercial aircraft to attend specific events or locations where there is no scheduled airline service for that date, route or time.

The charter industry is also crucial in delivering critical medical/evacuation missions and humanitarian relief efforts. The charter sector is best positioned to provide these critical capabilities with a vast global network of operators able to mobilise quickly and efficiently and draw upon specialist regional knowledge.

It can convert business jets to air ambulances or transport specialist cargo such as vaccines or medicines. According to the EBAA, approximately 70,000 medical flights take place globally using charter aircraft, of which 12,000 occur in Europe. London Oxford Airport and London Biggin Hill are among the busiest business airfields in Europe for medical evacuation flights. During COVID-19, London Biggin Hill remained open and fully operational and, as such, played a critical role in flying COVID-19 samples around the world for testing and research, transporting patients, engineers and scientists, and delivering and transporting urgently required medical supplies.

Given the challenges the air charter sector faces and what may be on the horizon with increasing APD, *Air International* asked Hogben about what the government needs to learn about the industry prior to introducing changes that may harm growth. He said: “International trade in goods and services has been an important driver of regional and national economic development. Business aviation is fundamental to international trade, where its connectivity is a key component to delivering national competitiveness and stimulating inward investment. The sector is a major employer and economic generator, connects regional communities with little or no airline service, helps companies be more efficient, productive and successful, and supports medical services when necessary."

From the information provided by the ACA, it's clear that business jet charter flights are valuable business tools that enhance efficiency and support growth across numerous industries, ensuring that the UK economy remains open and competitive for business on the global stage. Hogben points out: "One of the government's main targets is to make the UK the fastest- growing economy in the G7, and the support and development of business aviation will be vital to achieving this."

Extending the scope of the higher rate tax would disproportionally affect smaller operators, potentially making some flights unviable for aircraft that fall just over the 5.7-tonne restriction for the higher rate of APD. According to Hogben: "Smaller charter operators, who are vital to this aviation sector, will face disproportionate challenges in adjusting to these changes. With tight margins and price-sensitive clients, they will struggle to maintain their business in the UK, resulting in the loss of jobs and revenue to UK business and, ultimately, lower income tax. These smaller businesses often drive the growth of our future industry talent, and the impact of this significant increase in cost will magnify staffing shortages in the future. What's more, the increased costs could deter certain clients from travelling to regional destinations in the UK, reducing key investment in these areas. The government's decision to disproportionally increase APD on business jet flights by up to 70% overlooks the significant value of business aviation and could ultimately lead to reduced tax revenues over time."

Air International asked Hogben what ACA's next move is in terms of educating the government on the air charter industry. He said: "The ACA will continue to constructively engage with the UK government on how to best support the air charter sector and wider aviation industry, ensuring the UK remains well-connected and well-placed to deliver economic growth. We need to help the government understand the vital role of the air charter industry and the significant economic value it provides. We are keen to support and work with them to ensure that the critical services provided by The ACA's member companies continue to develop." **AI**

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Space 2025

Lunar, Mars and low-earth orbit exploration, and exciting new missions – including Artemis II sending astronauts around the Moon. **Mark Broadbent** reports

Artemis I lifts off in 2022; the second, crewed Artemis flight is planned for September 2025
NASA/Keegan Barber

The new year will see a continued fast pace of launches and developments in the commercial space domain from various companies and state institutions. And, momentously, there is Artemis II – where four astronauts in 50 years will become the first humans to fly around the Moon.

In-orbit refuel

Further test flights of the integrated SpaceX Starship/Super Heavy launch vehicle will take place in 2025, following the October 2024 test, which provided one of the year's most spectacular space technology achievements.

After launch from SpaceX's Starbase facility at Boca Chica, Texas, the Starship upper stage was delivered into a suborbital trajectory. The Super Heavy booster then turned around and fired its engines. The booster descended towards its launch pad, decelerated to a 'hover' and then slid horizontally towards the launch tower, which 'caught' the booster, before the engines shut down.

In addition to further test flights like these, SpaceX plans another significant test for Starship in 2025: the transfer of fuel in orbit between two Starship upper stages.

This will involve a 'target' Starship launching and positioning in orbit. A second 'chaser' Starship will launch and rendezvous with the target before docking. The chaser Starship will then transfer cryogenic propellant to the target, before the two spacecraft undock and de-orbit.

NASA says this 'prop transfer' is a "critical capability" for the Starship Human Landing System, the lunar lander variant of the Starship spacecraft under development for future NASA Artemis missions. This system will transfer astronauts from lunar orbit and land them on the moon's surface.

Polar orbit

Away from Starship, SpaceX has a busy schedule of launches for its Falcon 9 booster, the reusable medium-lift launch vehicle designed for reliable, repeated, and safe transport of payloads to orbit.

More than 30 Falcon 9 launches are planned for 2025, including, in January, the launch to the Moon of a second example of Intuitive Machines IM-2 Nova-C lander. A secondary payload aboard this launch will be the NASA Lunar Trailblazer orbiter, which will search for water ice on the Moon.

February 2025 is scheduled to see a Falcon 9 launch a SpaceX Crew Dragon spacecraft on the private Fram2 mission. This orbital flight will put an all-civilian crew, including Chinese entrepreneur Chun Wang, into a Polar orbit around Earth – a first for human spaceflight.

Multiple other Falcon 9 launches will put small satellites into low-Earth orbit for various organisations, including Axiom Space and Project Kuiper, an initiative by Amazon to build a constellation of 3,236 satellites to provide global broadband access. Project Kuiper will rival SpaceX's own Starlink constellation. In recent years, dozens of Falcon 9 launches have put hundreds of satellites into orbit for Starlink.

Another Falcon 9 launch scheduled for 2025 is the launch of the UK Ministry of Defence's next-generation SKYNET 6A military communications satellite. Airbus Defence and Space was awarded a full-service contract to design, develop, manufacture, assemble, integrate, test, and launch the satellite.

SpaceX's super-heavy launch vehicle, Falcon Heavy, is expected to launch classified payloads for the US Space Force in 2025. Falcon Heavy will also launch a lunar lander, the Griffin

ABOVE: ***SpaceX's launch facility at Boca Chica in Texas*** SpaceX via X

BELOW: ***The Blue Origin New Glenn's first stage pictured in November 2024*** Blue Origin via X

BELOW RIGHT: ***The Orion spacecraft that will be used in the Artemis II test flight to the Moon, planned for launch in 2025*** Lockheed Martin/David Wellendorf via NASA

Mission One, produced by Astrobotic under the NASA Commercial Lunar Payloads Services programme, which will take scientific payloads to the Moon's south pole.

New Glenn

The first launch of Blue Origin's New Glenn rocket is planned for spring 2025. New Glenn is Blue Origin's giant new flagship rocket – it is 100m tall – designed to carry heavy payloads (around 45,000kg).

Its reusable first stage, designed for a minimum of 25 missions, will land on a platform at sea downrange after launch. The rocket's seven BE-4 engines will generate 3.8 million tonnes of thrust on lift-off.

New Glenn's first mission will transport two satellites to Mars orbit for NASA's ESCAPADE (Escape and Plasma Acceleration and Dynamics Explorers) mission. The mission will gather data about the Red Planet's interaction with space weather.

NASA had intended the first ESCAPADE mission to launch in 2024 but was delayed. New Glenn's first-stage booster was only transported from the factory to Launch Complex 36 (LC-36) at the Cape Canaveral Space Force Station in Florida in late October 2024. LC-36 is the former NASA/US Air Force facility Blue Origin leased in 2015 to develop a launch site for its orbital rockets.

BLUE ORIGIN

Blue Origin is additionally contracted to launch satellites for the previously mentioned Project Kuiper, for which, incidentally, Arianespace and United Launch Alliance will also provide launch services.

Haven-1

A further eye-catching launch from the commercial space sector planned for 2025 is Haven-1, which its US-based developer, Vast, describes as "the first commercial crewed microgravity research, development, manufacturing platform, and space station".

Vast announced in October 2024 that Haven-1 will combine "the functionality of its state-of-the-art facilities for scientific research" with a "sophisticated and human-centric design".

Vast will position Haven-1 in low-Earth orbit, before a SpaceX Crew Dragon transports the crew to it. Vast proposes a subsequent larger station, Haven-2, as a successor to the International Space Station.

China

Away from commercial spaceflight, China will, in 2025, launch the Tianwen-2 mission to sample a near-Earth asteroid.

The China National Space Administration (CNSA) has already sent orbiters and rovers to the Moon and Mars with the Tianwen-1 mission. Now, the CNSA has announced that the next mission will land on a near-Earth asteroid called Kamo'oalewa.

Chinese media outlet *The Paper* reported in September 2024 that the Tianwen-2 mission will send a probe to the asteroid and return samples to Earth. Then, using Earth as a gravitational slingshot, Tianwen-2 will set course for a comet called 311P/PANSTARRS, where it will undertake close-range observations, sampling, and surface analysis.

The mission is a further step in China's space ambitions. Later this decade, the country plans two lunar south pole landings and a Mars sample return mission. According to *The Paper*, the CNSA official also stated that China is advancing to demonstration phases for its planned heavy-lift/super-heavy-lift reusable launch systems.

India is another Asia-Pacific nation with considerable spaceflight ambitions. The country's first crewed spaceflight mission, *Gaganyaan* (the Sanskrit word for celestial), was planned for 2025, but in October 2024, it emerged that the Indian Space Research Organisation had delayed the launch by a year.

ABOVE:
US developer, Vast, describes Haven-1 as "the first commercial crewed microgravity research, development, manufacturing platform, and space station"
Vast

BELOW:
SpaceX's Falcon 9 will continue commercial, and government launches in 2025
SpaceX

ABOVE: ***SKYNET-6A, the UK Ministry of Defence's next-generation military communications satellite***
Airbus Defence and Space

OPPOSITE: ***The Artemis II crew: Reid Wiseman (mission commander), Victor Glover (pilot) and mission specialists Christina Koch and Jeremy Hansen***
NASA

BELOW: ***A composite/timelapse of the SpaceX Starship booster recovering to its launch pad in October 2024***
SpaceX via X

Ariane 6

Mid-February 2025 is now the scheduled launch date for the first commercial mission for Ariane 6, the latest European heavy-lift launcher, following a full analysis of millions of data points collected during an inaugural test flight in July 2024.

A November 2024 Arianespace statement said: "The data confirms the excellent behaviour and performance of Ariane 6, and only a small number of deviations from forecasts, which have been fully understood and are being addressed. The flight software correction required to re-ignite the auxiliary power unit and de-orbit the upper stage has been completed."

Arianespace said the main and upper stages for the upcoming mission are now integrated at ArianeGroup's facilities in Les Mureaux, France, and Bremen, Germany. The stages will soon be transported aboard a "low-carbon ship" called Canopée to the launch site, the European Spaceport in French Guiana.

Ariane 6 will launch payloads for the French Space Agency and the French Armed Forces during its initial flight. Arianespace CEO Stéphane Israël commented: "We are preparing this fresh start for Europe in space with enthusiasm."

SaxaVord

An initial vertical launch is anticipated in 2025 from the UK's first commercial spaceport, the SaxaVord Spaceport on the Lamba Ness peninsula on Unst, the most northerly of the Shetland Islands.

Launches from SaxaVord were initially planned for 2022, but slow regulatory progress pushed back the timeline. Then, in August 2024, an engine fire occurred during a static test on the first stage of the RFA ONE rocket – the first rocket to be launched from the spaceport.

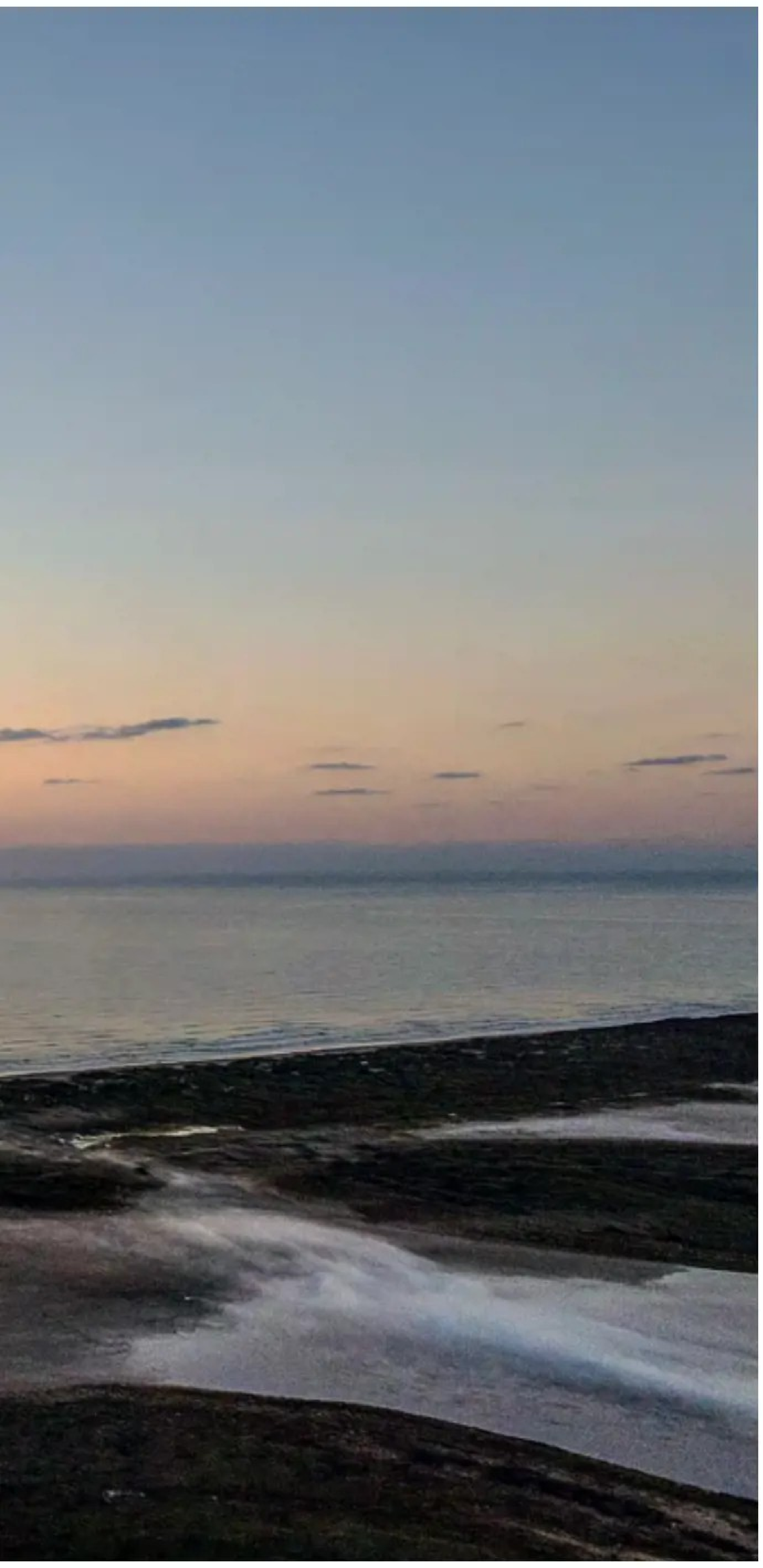
SaxaVord Spaceport issued an update in November 2024, which said the launchpad itself was undamaged, with minor repairs carried out to the launch stool. SaxaVord said: "While the fire was obviously a huge disappointment, it underlined the importance of testing and the high risk/high reward nature of the space industry."

SaxaVord said the German company RFA is building and qualifying a new first stage for the ONE rocket with more than 100 improvements at its Augsburg headquarters. Meanwhile, SaxaVord noted that work continues towards the completion of a new integration hangar at the Shetland launch site.

Artemis II

For all the various activities around launch and new technology, perhaps one 2025 space mission more than any other will capture the wider public's attention – the return to the Moon.

Artemis I, which took place in November/December 2022, was an uncrewed test flight of the Space Launch System rocket and Orion spacecraft. During the ten-day mission, Orion circled the Moon (and flew 270,000 miles beyond it), testing key systems such as the heatshield and the spacecraft's recovery.



Artemis II is the next stage. Its ten-day flight, currently scheduled for September 2025, will be NASA's first crewed flight test of Space Launch System/Orion. Four astronauts will be aboard – Reid Wiseman (mission commander), Victor Glover (pilot) and mission specialists Christina Koch and Jeremy Hansen.

Although Artemis II will not land on the Moon – it will undertake what NASA calls a crewed lunar flyby – it is nevertheless momentous. The flight will pave the way for a return to the lunar surface in the subsequent Artemis III mission, slated for 2026, and verify what NASA calls "foundational human deep space exploration capabilities".

More profoundly, as the first crewed mission into deep space since Apollo 17 in 1973, the Artemis II astronauts will be the first humans in more than half a century to see Earth from a perspective beyond low-Earth orbit.

In November 2024, NASA announced that the Orion spacecraft, which will sit atop the Space Launch System rocket, had been removed from the Final Assembly and System Testing cell at NASA's Kennedy Space Center in Florida.

The capsule was moved to the altitude chamber inside the Neil A. Armstrong Operations and Checkout building at Kennedy to complete further testing simulating the vacuum conditions of deep space. The tests there will enable NASA to complete the remaining test requirements on Orion and provide additional information to augment data gained during testing in summer 2024.

The recent advance in Orion testing does not guarantee a September 2025 launch date for the Artemis II mission.

A US Government Accountability Office (GAO) report issued on October 17, 2024, said there is "no schedule margin" for remaining activities around the development of Exploration Ground Systems (EGS) for Artemis.

Its report said: "In January 2024, NASA delayed Artemis II by nine months, but officials said that the delay only provided the EGS program about three months of margin to the September 2025 launch readiness date."

The GAO continued: "As of June 2024, officials said all this margin had been applied to technical issues already experienced at the pad during ML1 [Mobile Launcher 1] and pad testing.

"Earlier in 2024, the program was reserving that time for technical issues that may arise during testing of the integrated SLS [space launch system] and Orion vehicle or if weather interferes with planned activities, among other things."

The GAO pointed out: "Officials said it is likely that issues will arise because this is the first time testing many of these systems. Given the lack of margin, if further issues arise during testing or integration, there will likely be delays to the September 2025 Artemis II launch date." **AI**

CATHAY PAC
OUR ALL-NEW BUSINESS CLASS
THE ARIA SUITE
CATHAY PACIFIC

From SKETCHBOOK to the skies

IFIC
全新
爾雅商務艙
THE ARIA SUITE

Cathay Pacific unveiled the new Aria Suite at an exclusive event presented by special guest Fala Chen (fourth from left), Cathay Group CEO Ronald Lam (third from left), chief customer and commercial officer Lavinia Lau (third from right), chief operations and service delivery officer Alex McGowan (second from right) and chief financial officer Rebecca Sharpe (second from left)
Cathay Pacific

Hong Kong's flag carrier Cathay Pacific is transforming its passenger experience with the Aria business suite. **Alex Preston** investigates

For nearly eight decades, the Cathay Group has led efforts to position Hong Kong as one of the world's leading international aviation centres.

The COVID-19 pandemic seriously stymied these endeavours, with the Group experiencing three challenging years, best exemplified on March 12, 2022, when it carried just 58 passengers. But the Group survived and emerged with a new purpose – "To move people forward in life".– rebuilding Cathay for the benefit of its passengers, people, shareholders and Hong Kong as a whole.

The jewel in the Group's crown is Cathay Pacific, a full-service airline and the national carrier of Hong Kong. Cathay Pacific's strategic vision is to be the world's best premium airline, and its ambitions received a shot in the arm in mid-2024 when it returned to the top five best airlines at the Skytrax World Airline Awards, a ceremony that also saw its economy class named the World's Best.

At the time, Cathay Group CEO Ronald Lam declared: "These achievements will motivate us to continue to go above and beyond for our customers every step of the way as we strive to become the world's best premium airline."

To ensure this is achieved, the Cathay Group has committed more than $12.8bn in investments over the next seven years, upgrading its fleet, cabins, airport lounges and more. As Cathay Group Chair Patrick Healy explained, the group is "turning the page and embarking on a bold new strategy for the future, not just in scope but also in quality."

Cathay Pacific will introduce new seat products in each of the coming three years. The first – an all-new business class, Aria Suite, together with new premium economy and refreshed economy onboard its retrofitted Boeing 777-300ER aircraft – debuted on its Hong Kong-Beijing route in mid-October 2024.

It's a far cry from *Betsy*, Cathay Pacific's first aircraft, a Douglas DC-3 that flew passengers around the region in the 1940s and 1950s. The airline says the new cabin offers an intuitive and effortless inflight journey, thanks to the artistry and craftsmanship of London-based multinational design company JPA Design.

A rich heritage

JPA Design's creative director, Elliott Koehler, explained that the company has its roots in designing luxury hotels and transport interiors, including the legendary Venice-Simplon-Orient Express. Its aviation journey took off in 1998, when it presented a design concept for a Singapore Airlines business class seat. Koehler said: "This opportunity led to our first aviation project: the design of the 747 first class suite for Singapore Airlines. Since then, aviation design has become a core part of our expertise."

Over the years, the design team has crafted innovative cabin interiors for industry leaders such as American Airlines and the iconic A380 business class seat for Singapore Airlines: "Our experience reflects a commitment to elevating the passenger experience through thoughtful, luxurious and human-centric design."

TOP:
The Aria business class suite is the first branded seating product for Cathay Pacific
Cathay Pacific

RIGHT:
Designed by JPA Design, the Aria Suite is the crown jewel of Cathay Pacific's refurbished 777-300ER cabin
JPA Design/Cathay Pacific

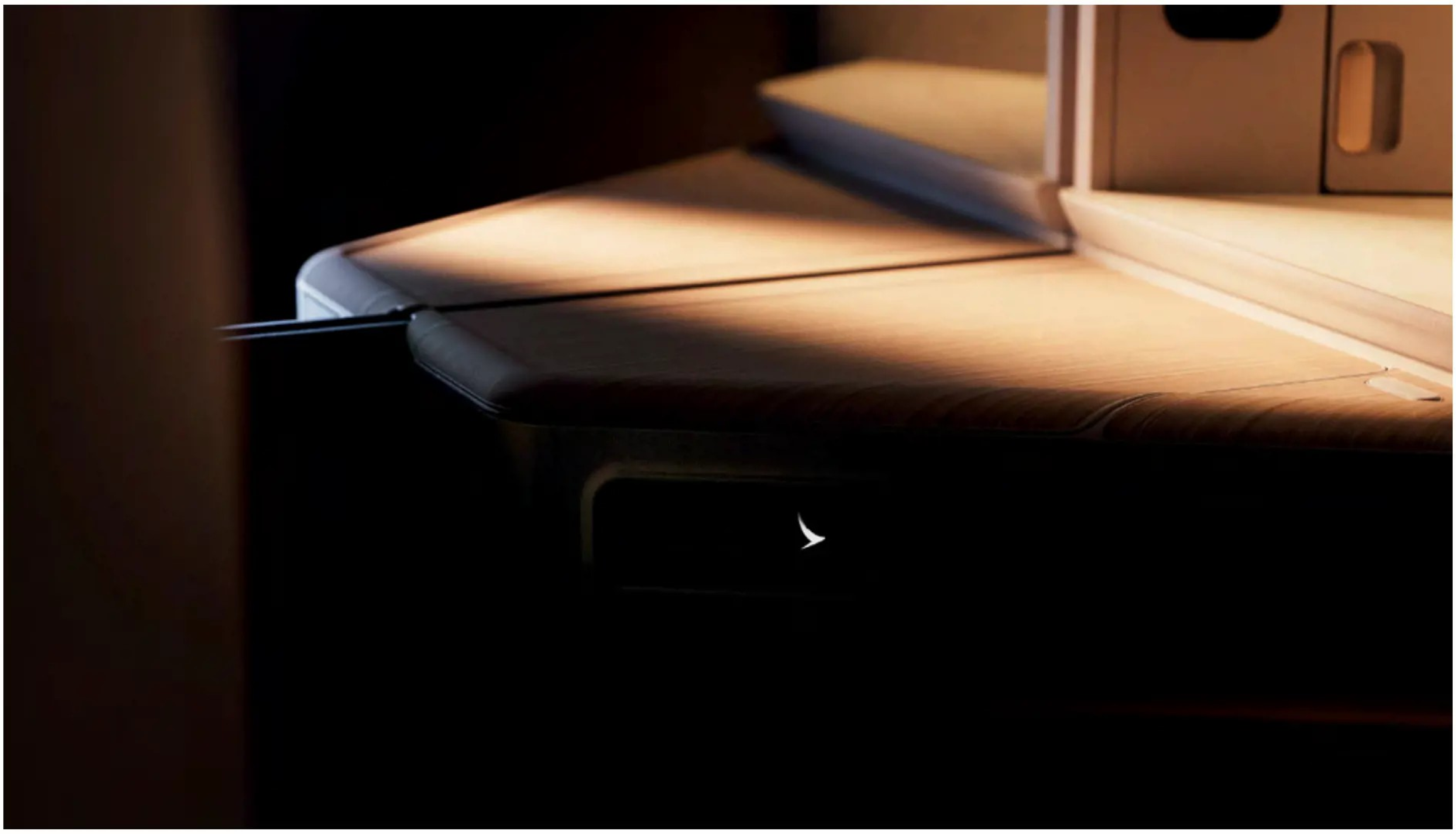
OPPOSITE TOP:
The new interiors embody a refined, sophisticated ambience, featuring a harmonious palette of nature-inspired materials
JPA Design/Cathay Pacific

OPPOSITE RIGHT:
A signature finish, 'Warm Black', is applied throughout the cabins, ensuring a harmonious and consistent design language
JPA Design/Cathay Pacific

The origins of JPA Design's relationship with Cathay Pacific can be traced back to 2008 and a complete redesign of their widebody cabins: "Over the years, Cathay Pacific has become one of our flagship clients, with whom we've collaborated on numerous transformative projects. In 2011, we introduced the reverse herringbone cabin layout, a pioneering innovation that reshaped the customer experience across the entire Cathay Pacific fleet. This longstanding collaboration has allowed us to better understand Cathay Pacific's brand and customer expectations, enabling us to continually refine and elevate their in-flight experience."

The recent landmark project with Cathay further strengthens and extends this partnership. It entailed a comprehensive cabin upgrade that, according to Koehler, "incorporates highly customised interior designs and brand touches that have meticulously transformed Cathay Pacific's 777-300ER fleet, reinforcing the airline's expertise and dedication to the onboard customer experience."

Cathay's 58 x 777-300ERs will be fitted with new business and premium economy cabins, as well as a refreshed economy



> *“Cathay’s 58 x 777-300ERs will be kitted out with new business and premium economy cabins, as well as a refreshed economy cabin, in a process that is expected to last until mid-2027, with a rate of one aircraft reconfigured every month”*

cabin, in a process that is expected to last until mid-2027, with a rate of one aircraft reconfigured every month. According to Koehler, the challenge of blending brand-new cabin seats alongside a refreshed interior is a welcome one: “Our view is that for any aircraft design project, the greater the scope, then the greater the opportunity for us to create a more consistent and brand-led experience. Challenges arise when projects involve just a single cabin as it becomes more difficult to design so that it blends in with other cabin elements that have been designed at different times. Thankfully, this was not the case here and we had full nose-to-tail responsibility.”

The design programme began some years ago, but much like the rest of the aviation industry, the coronavirus pandemic forced a delay in the programme. Koehler said that throughout this period, the team continued to work, but at a reduced level: “On resumption, our design story and principles were validated against the original brief with only minor adjustments, resulting in ae world-class cabin interior.”The human touch

“The overarching concept for this project was human-centric design,” Koehler explained. “We focused on optimising each cabin’s features to provide maximum comfort and control for passengers. The new interiors embody a refined, sophisticated ambience, featuring a harmonious palette of nature-inspired materials, incorporating smart lighting design that creates a warm, welcoming environment.

“Drawing inspiration from Cathay Pacific’s award-winning airport lounges, we meticulously selected every material to cultivate a calming atmosphere throughout the cabins. Each interior feature was designed to offer an intuitive, seamless experience, ensuring passengers feel relaxed and at ease from the moment they board.”

This extends to integrating IFE and associated seat technology, which Koehler said were key parts of the design process. There was close collaboration with the hardware suppliers to ensure harmony with the overall human-centric design goal: “Much consideration was

TOP RIGHT:
Passengers can take control of their environment with customised settings for lighting, seat position and more
JPA Design/Cathay Pacific

RIGHR:
The Aria Suite includes bespoke lighting, such as this signature lamp
JPA Design/Cathay Pacific

OPPOSITE TOP:
Intuitively designed storage spaces keep everything a passenger needs within easy reach
JPA Design/Cathay Pacific

OPPOSITE RIGHT:
A spacious lie-flat bed is lined with ethically-sourced wool for breathable comfort
JPA Design/Cathay Pacific

given to passengers with limited mobility and how their experience could be just as discreet and comfortable as every other passenger. The integration of Passenger With Reduced Mobility (PRM) access with the Aria cabin is almost imperceptible, but facilitates all needs and comfort economics."

All in the details

Koehler and his team worked across three cabin classes and had to ensure a distinctive design language for each while maintaining consistency and unity. To realise this, they developed a signature finish for Cathay Pacific, known as 'Warm Black', which was applied consistently across the interior. Additionally, they collaborated closely with a textile manufacturer to create custom fabrics exclusive to Cathay Pacific. These bespoke elements establish a cohesive and unified aesthetic throughout the cabins, enhancing the airline's distinct identity across every class.

Koehler continued: "Our material palette places an emphasis on natural materials and tactile finishes. These reinforce a connection to nature and quiet luxury that begins from the start of the journey in the Cathay Pacific lounge. We are always trying to connect the customers' experience from the lounge to the aircraft, providing a holistic design ethos that translates across the various touchpoints."

Such CMF (colour, materials, finish) elements and details, which the passenger can often overlook, are accentuated through intelligent lighting and mood lighting, which helps support circadian rhythms. Koehler explained that passenger well-being and comfort were top priorities when designing the cabin lighting, with an emphasis on creating a refined, welcoming and luxurious atmosphere. For the 777-300ER programme, mood lighting has been extended to the premium economy and economy cabins, enhancing the overall ambience throughout the flight.

In the premium economy cabin, the design team placed a reading light beside each seat's headrest for added convenience. They designed a bespoke feature light for the Aria business class seats that seamlessly combines wash and reading lights into a single fixture: "In addition to our signature lamp, the overall lighting in the suite gives the customer a real sense of feeling welcome and being able to customise and control the mood of their own space. Additionally, the seat control panels are subtly backlit, providing a soft glow that minimises disturbance if passengers wake up mid-flight and helps maintain their natural circadian rhythm. All lighting within the suite can be controlled in intensity and position, allowing each passenger to customise their experience in a unique and seamless way."

Lighting also accents Cathay's new feature, Gallery in the Skies, a curated collection of artwork in each 777-300ER business cabin. JPA Design worked with the airline to showcase unique work by artists with strong connections to Hong Kong. Through a rolling programme, these artworks will be gradually introduced onboard: "To enhance this feature, we backlit the frame of each artwork, replicating the display of art within a gallery and creating a visually striking experience for passengers. This thoughtful display invites passengers to engage with the art in a way that

> *"One of Aria's standout features is a door enclosing each suite, which functions as a sliding partition between seats. This creates a sanctuary for each passenger, enabling them to have an extra level of privacy and enhancing their luxurious experience"*

OPPOSITE LEFT:
The Aria Suite is characterised by a wrap-around seat design, while the privacy door and sliding partition create a greater sense of privacy and comfort
JPA Design/Cathay Pacific

RIGHT:
Every detail of the Aria Suite has been carefully considered to elevate the passenger experience on board
JPA Design/Cathay Pacific

BELOW:
Passengers in the Aria suite can keep devices powered up with wireless charging functionality and stay connected with complimentary inflight Wi-Fi
JPA Design/Cathay Pacific

elevates their in-flight experience.” In addition to the complimentary Wi-Fi for all business class passengers, a bespoke tag and QR code sit beside each artwork, providing additional details about the artists.

In 2023, the airline published its Sustainability Report, which addressed its commitment and progress in environmental, social and governance issues. The 777-300ER cabin refurbishment project has not neglected these responsibilities: “Sustainability is always a key pillar of our design process. JPA Design was the first design house to become a member of the Green Cabin Alliance, a consortium of industry suppliers whose shared aim is to reduce the environmental impact of aviation cabin interiors. Among other sustainable initiatives on this programme, we introduced a blend of wool and Econyl (regenerated nylon) carpets in business class and 100% Econyl carpets in economy in order to incorporate recycled materials and reduce waste. The offcuts from the materials used within the cabin have been repurposed for textile art pieces that will be showcased within Cathay Pacific lounges.”

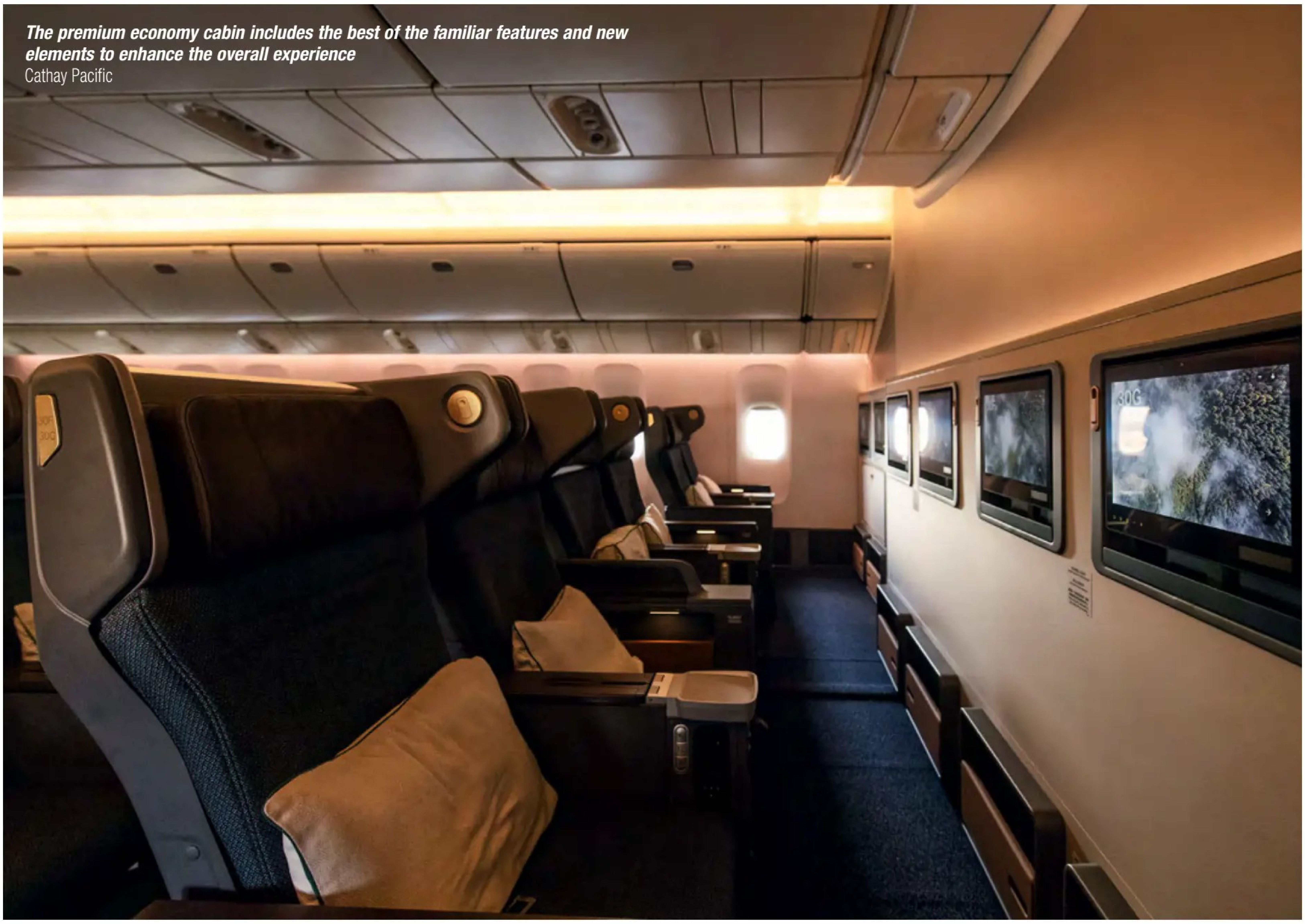
Business class reimagined

The new cabin experience was introduced at a special ceremony for distinguished guests, valued customers, members of the media and Cathay employees at Hong Kong Aircraft Engineering Company Ltd’s (HAECO) hangar at Hong Kong International Airport ahead of its commercial revenue debut on the airline’s Hong Kong-Beijing route. The airline’s retrofitted 777-300ER will progressively be deployed on other regional and long-haul routes.

So,what can passengers expect?

The centrepiece of the new cabin is the Aria business class suite, the airline’s first branded suite and a replacement for first class on the 777-300ER. Koehler said: “In creating the all-new Aria business class suite, our goal was to deliver exceptional comfort, privacy, and functionality through thoughtful design. The suites feature a spacious lie-flat bed that extends fully for restful sleep, along with new elements like a wrap-around seat design and a privacy door. These additions maximise comfort and enhance the sense of seclusion, providing passengers with an elevated, private in-flight experience. The bed surface space is maximised to be as large as possible with an innovative mechanism and surface material on the translating armrest.”

One of Aria’s standout features is a door enclosing each suite, which functions as a sliding partition between seats. This creates a sanctuary for each passenger,



The premium economy cabin includes the best of the familiar features and new elements to enhance the overall experience
Cathay Pacific

enabling them to have an additional level of privacy and enhancing their luxurious experience and relaxation while on board. Koehler said the company's experience working with doors on aircraft cabin suites ensured a smooth process. In collaboration with the seat manufacturer, the team delivered a more integrated door, in line with the overall design language, that meets all regulatory requirements.

Each element of the Aria suite has been thoughtfully designed to be as intuitive and useful as possible. Convenience is paramount, from smart stowage to a large side table complete with a wireless charging station. The latest aviation technology has been seamlessly integrated into the cabins, with personal 24-inch 4K monitors serving as the control centre of the experience. With just a few taps, passengers can easily adjust their seat position, lighting level and more. The settings can be effortlessly saved with one touch, just like the comfort settings in a luxury vehicle, which can be saved for each driver. For those reclining, a panel conveniently placed next to the armrest allows for effortless customisation of the in-flight experience

An elevated experience

Throughout the design process for the new premium economy seats, Koehler and his team sought to retain the features that customers knew and loved from existing seat products, while incorporating new features to enhance their overall comfort.

The new premium economy cabin is distinguished by its unique design, featuring distinctive touches and thoughtful customisation tailored to the needs of passengers: "We have created an innovative seat design incorporating bespoke textiles and enhancing the sense of personal space for passengers. The seats boast generous recline and ample legroom, complemented by a supportive footrest that is wrapped in real leather, ensuring optimal comfort from take-off to landing."

Privacy and comfort are enhanced by incorporating innovative wings near the headrest, allowing passengers to enjoy a greater sense of personal space. Each seat features an integrated reading light that customises the travel experience while reducing disruptions to fellow passengers. Also incorporated are smart storage options throughout the cabin class, enabling seamless access to personal devices and travel essentials. A larger meal table makes working and dining even easier,

One of the cabin's defining features is the introduction of 4K 15.6-inch widescreen monitors in premium economy, which significantly enhance passengers' in-flight entertainment. Bluetooth audio connectivity is now available throughout the aircraft, providing even more convenience and flexibility.

The new premium economy cabin also includes two dedicated lavatories – one on each side of the aircraft. Equipped with touch-free features, these lavatories minimise contact to ensure a seamless, hygienic experience and ensuring peace of mind.

The economy seat is refreshed with a new dress cover, enhanced cushioning, an adjustable headrest and improvements to the space for customers seated in front rows. The new 4K IFE has personal Bluetooth connections and offers exclusive features, such as checking lavatory occupancy and which will soon allow passengers to sync their inflight entertainment with their personal devices.

Storage and supporting surfaces have been designed to hold all personal devices with ease and provide access to power. This includes a dedicated shelf that keeps a mobile device at eye level, allowing passengers to watch their own content easily.

The new finishes and technology features ensure that Cathay Pacific's award-winning economy cabin is class-leading in comfort and passenger delight.In Koehler's words, the result of this design project is "holistic and consistently compelling." **AI**

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Eight Questions

Danny Hakker was appointed CEO of MAAS Aviation in October 2024, having previously been the company's chief financial officer the year before. With more than 20 years of experience in the transport and distribution industries, among many others, his enthusiasm and vision for the company look set to increase the group's commercial focus and drive new changes

Question 1: Since you have been appointed CEO, what has been the biggest challenge to date and how have you overcome it?

It's still early days for me as CEO of MAAS, but one of the biggest challenges we face as a business is navigating industry demand volatility while ensuring that we remain operationally efficient and competitive.

Managing seasonality in the aircraft painting sector is another ongoing challenge. We have traditionally seen this in our MRO work but are now also experiencing it on the OEM side of our operations, mainly due to supply chain issues. This requires us to find solutions for issues such as skill-set retention while scaling up and down our workforce at different times of the year. One way we're addressing this is through secondment programmes, where our teams move to different locations depending on the seasonal requirements.

Of course, escalating operating costs, supply chain and production issues, and recruitment and retention challenges all pressure the sector. But these challenges are not exclusive to MAAS, the aircraft painting and coatings market, or even the broader aviation industry. They are far-reaching business issues that we must all adapt to.

Within MAAS, we foster a culture of continuous improvement, encourage honest and open feedback at all times, and empower our colleagues to make swift decisions when needed. Collaboration and leveraging a strong team remain the most effective ways to overcome challenges.

Question 2: Where do you see MAAS Aviation developing within the sector?

Our main priority is to consistently deliver the high-quality painting standards we are known for, working in partnership with our customers to optimise their operations. We are also focused on strengthening our position as a global leader in aircraft painting by expanding our geographical footprint and advancing our technical expertise.

On the MRO side, MAAS will continue to invest in modern facilities that allow us to diversify our customer base and serve airlines with mixed fleets. Regarding our OEM partners, we see opportunities to further support them with outsourced supplementary surface solutions, allowing them to focus more on their core activities.

We aim to pioneer sustainable practices, be solution-oriented for our customers and deepen our relationships with commercial and private aviation clients. We will always focus on providing unparalleled quality, operational excellence and customer satisfaction.

Question 3: What do you think will happen regarding paint processes and techniques in the next few years?

Automation is a key area for development, especially given the personnel challenges faced by the industry. Repainting aircraft is a very labour-intensive process, especially the stripping, cleaning, masking and preparation phases. However, these can also be extremely difficult parts of the process to automate. Where very detailed masking, lining-out and sanding are needed, a robotics solution would likely not be cost-effective, but it's an area we continue to monitor and explore.

In my opinion, automation is still a very long way off in the MRO sector due to the different configurations of each customer's aircraft. However, there is more scope for it in OEM operations, as repeatability is key.

Another area likely to become commonplace much sooner is the use of digital technology and augmented reality for virtual training in painting techniques to develop and improve skill sets. This technology is already available and is proving to be very effective, not to mention also quite good fun! I had the pleasure of trying it myself recently while at the MRO Europe tradeshow in Barcelona in October. Exo-skeleton suits are another interesting technology that has entered the market and is being looked at as a tool to support people with labour-intensive sanding jobs, for example.

However, the most significant innovations are in the paint systems being developed, which are much more environmentally friendly and deliver great advances in drying times. These more sustainable and often waterborne solutions are fast replacing the older chromated products. In the automotive sector, water-based products, and UV technology to aid drying times have been established for a long time. Still, the additional testing and approvals needed in the aviation sector means it takes a lot longer to break through. But many have been introduced now. In terms of the next big jump, it's likely to be the introduction of water-based and dual-cure technologies to enhance processes further.

***Question 4:* The aviation sector must balance its work with an ever-increasing set of green environmental rulings. How do you believe MAAS Aviation can meet these, and how, if so, do they impact current processes?**
At MAAS, sustainability has been a crucial part of our business plan for many years, and we work hard to be as 'green' as possible in all our operations and facilities. Since 2022, we have been reporting our emissions as part of the Carbon Disclosure Project (CDP). We are very proud of our progress and recognition of our efforts to manage our environmental impacts. While this positions MAAS as a pioneer in our sector, our objective is to implement further carbon reduction initiatives and realise a 'B' score by the end of 2025. The goal is to reduce our Scope 1 and 2 emissions by 55% by the end of 2030 vs 2023.

Furthermore, all our sites in the Netherlands, Lithuania, Germany and the United States are ISO-14001 accredited. Our paint bays all have underground sump systems built below the hangar floor to ensure no waste chemicals or contaminated water ends up on the apron or local area. We also continue to expand our procurement of certified 100% renewable electricity across our locations, with our Lithuanian facility leading the way. In the United States, we offset our utility usage to ensure that our operations there contribute to our overall carbon reduction goals.

MAAS aviation

TOP RIGHT:
Each aircraft painted requires 5km of masking tape to complete the average job. In addition, the paint shops use paper and plastic sheeting equivalent to the size of 35 football pitches

All images via MAAS Aviation

MAAS Aviation has developed its own unique recycling technology, which allows us to recover 80% of the solvents we use. These solvents are then redeployed to clean equipment such as paint guns, lines and pipes. In addition, all the dry materials we use in the painting process, such as paper, plastic sheeting and tape, are also recycled.

***Question 5:* We work closely with all of our partners, especially the major aircraft paint manufacturers, to ensure we use the latest coatings and techniques, which reduce fuel usage and carbon emissions during the aircraft's lifetime.**

It's safe to say that we take environmental sustainability extremely seriously. Over the next three to five years, we plan to implement more measures to continue reducing emissions and further limiting our environmental impact.

What are airlines expecting from their paint finishes now regarding duration, durability, etc? What are the 'golden rules' that must be followed before a finished aircraft rolls out for the client?

Our airline customers expect their coating finishes to look great and perform well until their next heavy maintenance checks, which are usually every six to eight years, depending on their routes and environment. Using the latest pre-treatment technologies, coupled with basecoat clearcoat systems and our high-quality painting techniques and processes, we see excellent longevity in the coating systems we apply, at times extending well beyond our customers' scheduled checks.

All repainted aircraft undergo various stages of inspection throughout the process to ensure compliance with the Structural Repair Manual and Aircraft Maintenance Manual. The final inspections are very thorough for quality and safety. In line with our Quality Management System, key milestones are built into the process, which are checked, recorded and signed for by our specially trained supervisors and the on-site engineer.

The team physically checks all critical parameters (film thickness, temperature, humidity, substrate temperature, adhesion, gloss, etc), which are recorded in the customer work pack and double-checked by the engineers. This diligence and commitment to the highest quality of work ensure that every aircraft that leaves one of our facilities is a gleaming representation of our customer's brand and will stand out on runways worldwide for many years to come.

BELOW:
The specification of ultra-modern facilities reflects MAAS Aviation's design expertise, which includes fully climate-controlled paint shops, computerised management systems and high-lux lighting

MAAS aviation

LEFT:
Globally, MAAS Aviation can paint 580 aircraft a year

BELOW:
In partnership with Embraer, MAAS Aviation created the striking **Profit Hunter** *paint scheme for the E195-E2, which the aircraft wore as part of a sales demonstration tour by the OEM*

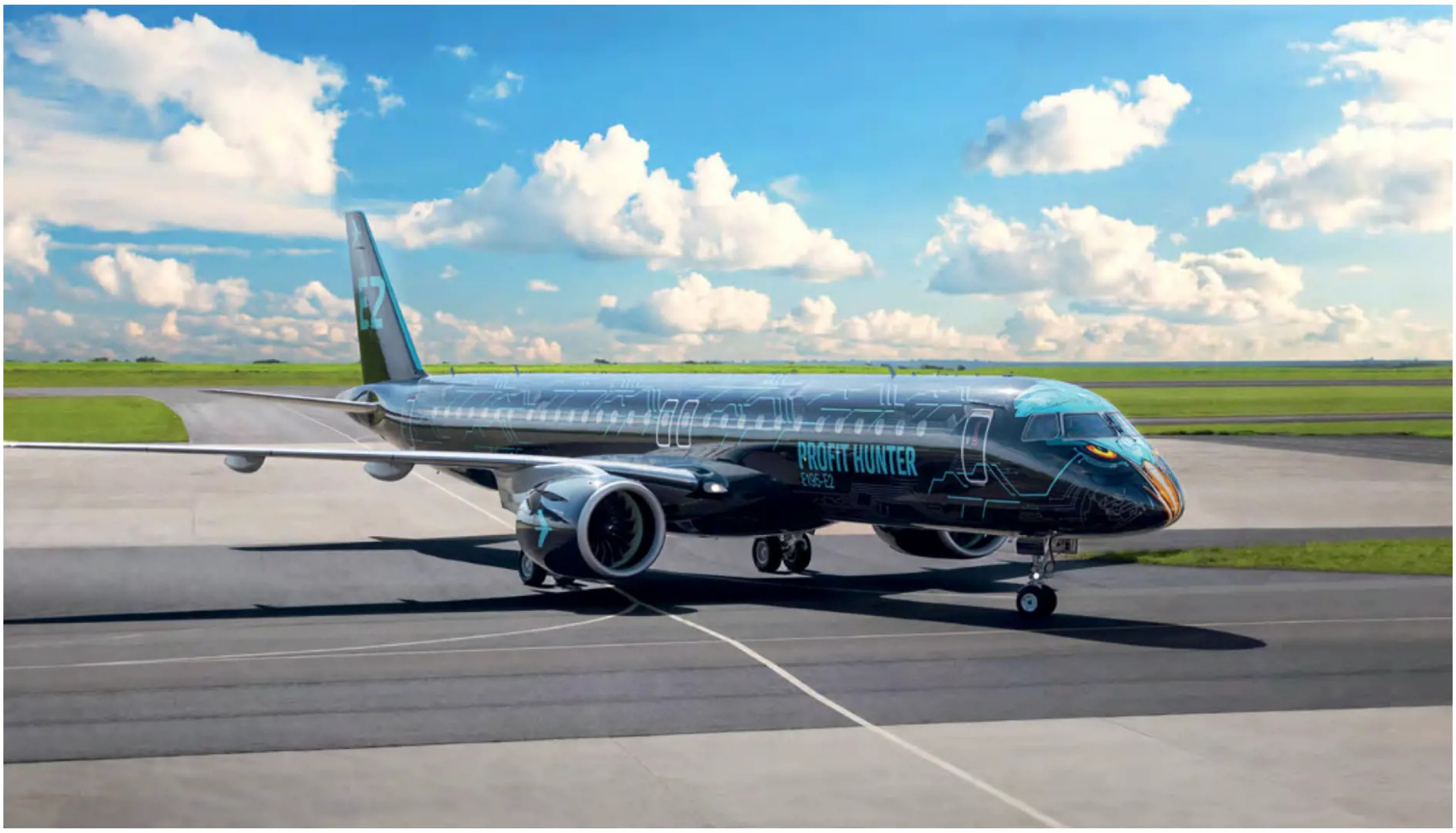
***Question 6:* MAAS Aviation recently completed two A319s for the Hungarian Air Force. Are you investigating the military sector? If not, what other sectors does MAAS Aviation have a presence in, such as business jets and corporate?**
MAAS has a long-established history supporting airlines and leasing companies in the commercial sector. We also support military, cargo, VIP business and corporate jet customers, manufacturers and MROs. We are most well known in the commercial aviation sector, but have extensive experience and expertise in the VIP/corporate sphere. Due to the nature of VIP customers, this is not often widely publicised.

MAAS is recognised globally as one of the leading specialists in complex and detailed liveries. We are proud to have painted several high-profile aircraft, such as the Embraer Profit Hunter Tech Eagle, and have worked on many more discreet projects, painting BBJs, ACJs, Gulfstreams, Globals and Challengers for high-net-worth individuals, corporates and governments.

***Question 7:* Looking toward the future, what would you like to see develop across the aircraft painting and finishing sector? What do you believe it needs?**
Looking forward, I expect consolidation in the sector, and there is a need for more investment in workforce development to ensure skilled professionals are available to meet future demands. Painting planes is physically strenuous work, so it's not for everybody. But when done well, it is true craftsmanship, and we need to do more to attract and retain talent in the sector. This is a real challenge and one that the whole MRO industry needs to be addressing and fast! Forecasts report that fleets are growing and will double in the next 20 years, so a collaborative, industry-wide approach to solving this problem must be needed.

I would also like to see further advancements in sustainability and greater co-operation between service providers and paint companies to streamline processes.

***Question 8:* On a personal level, how do you spend your free time? Any hobbies that you enjoy?**
Outside of work, I enjoy watching my children's hockey matches and coaching a hockey team for players with disabilities. I genuinely enjoy their energy and spontaneity. My partner and I often visit museums and love going on city trips. My camera always comes along so I can photograph street art. I play padel with friends to stay fit and enjoy working in the garden. On weekends, I love to cook, especially the famous recipes from my dad. **AI**



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A battle manager sends real-time commands to an AI-controlled aircraft during a flight test over Iowa Lockheed Martin

Pioneering electric aviation platforms, like those from Vertical Aerospace, look set to make a significant impact this year
Vertical Aerospace

Next Month

Airborne battle management of AI-controlled aircraft

Crewed-uncrewed teaming missions using real-time AI-controlled aircraft may be how strike missions will be conducted in the future, according to Lockheed Martin's Skunk Works

2025, now's the time for eVTOL

The latest update on air taxis in a crucial year for certification and commercialisation

Blended wings

Air International examines the revived interest in futuristic-looking blended wing body concepts

Airline retailing

The offer and order model can transform the traditional airline retail sector, but how can it help airlines unlock new revenue streams?

Technology concepts from the 1990s are making a return to aviation as OEMs believe such innovative designs can also reduce emissions
BAE Systems

New products being sold in new ways and getting closer to customers is a process many airlines are now exploring
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